# DISCOVERY

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Edited by JOHN A. BENN

Volume VIII

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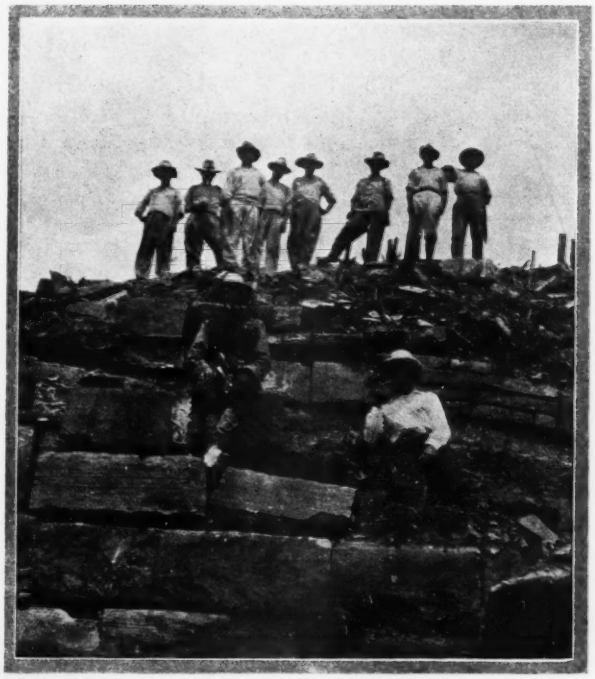

EXCAVATIONS IN PROGRESS AT LUBAANTUN.

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## Editorial Notes.

Following the announcement that the Trustees of the British Museum have now sanctioned a grant for further excavation in Honduras, we publish this month a full account of the archaeological investigations so far carried out under the direction of the author, Mr. T. A. Joyce. As was pointed out in a recent annual report on the colony, it is probable that Columbus discovered the coast about 1502, when on his way from Cuba to find a passage to the Indies, and it is also likely that the great Cortez passed through the western part of the colony on an expedition undertaken in the year 1524. But long before Columbus and Cortez, indeed before the Christian era—possibly 5,000 years ago—it is now thought that the inhabitants of that part of the world were sufficiently civilized to have had an exact system of chronology; it is even supposed that the civilization of Central America is older than that of Babylon or Assyria. During the exploration last summer, Mr. Joyce directed attention to the Maya ruins near San Pedro de Colombia in the Toledo district, which are named "Lubaantun," meaning in Maya "the place of fallen stones." Although the existence of these ruins had been known for many years, and they have been visited from time to time by European officials and others, no excavation work was carried out prior to this. A number of artifacts, depicting the Maya civilization of the period, were discovered by the party, and these are now on view at the British Museum.

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A good deal of attention has been devoted during the past few weeks to problems connected with the origin of the war, both in continental and English newspapers, owing to the simultaneous publication of the concluding volumes of the German Foreign Office documents, and the first part of the British diplomatic papers dealing with the period 1898-1914. The German documents just issued cover the two years prior to the war, and form the last section of the whole work entitled "Europe before the Catastrophe"; of the British papers, the eleventh and final volume is the first to be published, and has been prepared by Mr. Headlam-Morley, who is historical adviser to the Foreign Office. The series is being selected and edited by Dr. G. P. Gooch and Dr. Harold Temperley, and is of the highest political and historical importance, for it will contain a large selection of official correspondence practically none of which has hitherto been made accessible to the general public. Dealing with the few weeks from 28th June to 4th August, 1914, the volume now issued (H.M. Stationery Office, 10*s.* 6*d.*) is in fact a new and greatly enlarged edition of the "blue book" published in that year, but containing a wealth of new material.

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With regard to the principle on which the volume has been prepared, it is stated in the introduction that simply to reissue in its original and unparaphrased form the complete text of the documents, inserting those passages that had been omitted, would not have satisfied the criticisms and stilled the suspicions which had been aroused. "The only thing to do was to publish the whole correspondence, including every telegram and despatch, however unimportant and incorrect, in any way relating to the origins of the war." The volume contains also much material which was not available in 1914, and could not have been used then. For instance, it includes all relevant extracts from the private letters of Sir Edward Grey,

as well as certain minutes of great importance made at the time on the papers. As these were written on the spur of the moment, " with full confidence that they would under no circumstances be published, at any rate until many years had elapsed," they are unique in showing the impression made on those whose duty it was to advise the Secretary of State. " From them we can see how the confidence that this crisis would be surmounted, as many other crises had been in the last few years, gradually gave way to concern and apprehension." The discussion to which these newly-published documents have given rise in recent weeks has largely centred on the vexed question of war-guilt and this will be dealt with shortly in *Discovery*, by Mr. R. B. Mowat, who elsewhere in this issue discusses new light that is forthcoming on an earlier European war crisis—that of 1875.

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It is reported from New York that Dr. William Beebe, the American naturalist, who has previously made investigations in the Saragasso Sea and at the Galapagos Islands, is having constructed for an expedition round the Equator next autumn a steel tank in which he will descend to observe marine life a mile deep in the ocean. Instead of being supplied with air pumped from the surface, the tank is to be fitted with a cylinder of compressed oxygen, and through a heavy glass window it is proposed to study and photograph the habits of deep-sea fishes. Dr. Beebe's cinematography will not be the first undertaken in such circumstances, however, for in 1912 a similar achievement—though on a much smaller scale—was successfully accomplished by two other of his countrymen, Ernest and George Williamson, who exhibited their results at the first International Motion Pictures Exhibition held in New York that year. The attention these attracted gave rise to the subsequent financing of the Williamson Submarine Expedition, which two years later set out for the Bahama Islands, where conditions were favourable to the work. The apparatus used was a tube some sixty feet in length and three feet in diameter, made up of overlapping steel scales or plates, covered on the outside by a waterproof fabric of canvas and rubber. As it hung beneath the barge from which it was suspended, it was best compared to an enlarged Chinese lantern ; since it was open at the surface no artificial respiratory arrangements were necessary. While, of course, it was only adapted for shallow-water work in the West Indian seas, the films obtained with the Williamson tube were remarkable and served to prove that submarine photography was a practical proposition. Whether Dr. Beebe will meet with the same success at the much greater depths which he proposes to fathom has yet to be demonstrated, but it is expected that strong searchlights will be necessary for his purpose.

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The discovery of an actual basis of fact underlying any novel is always a matter of widespread interest, particularly in the case of the great romances that have delighted generations of readers. Instances are recorded in which adventurous spirits have determined upon a search for the famous " Treasure Island " of Robert Louis Stevenson, with what success, so far as we know, has not been reported ; but it must be confessed that, until we heard that a film is now in process of being made of the story of Robinson Crusoe, we did not recall that his Island has been identified geographically. Tobago, a few hours' journey by sea from Trinidad, and served by a weekly steamer from there, has already been " rediscovered " in the first part of the film representing the landing of Crusoe, and Mount Dillon, a lofty point on the island, has been chosen as the place of his look-out post. The work was described last month by a West Indian correspondent of *The Times*, who recalls that Defoe took as the basis of his romance the account of a sailor who spent many years of loneliness on the island of Juan Fernandez. In process of writing the scene of the story was altered to Tobago ; and that the author had this island in mind is clear from Crusoe's description of the events leading up to the shipwreck. It is to be hoped that, when the film comes to be displayed, the producers will draw attention to the historic character of the surroundings in which it was made. The hero is reported as being dressed in a seventeenth-century costume, with the long boots of the period, specially obtained for the purpose ; while the " Spaniards " of the story will be impersonated by members of the planting community, who manage the cocoa and coconut estates of the island.

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We welcome this month some thousands of new readers who, in accordance with an announcement that appeared in the December number of *Modern Science*, are now receiving *Discovery*. The magazine, which a year previously had incorporated *Conquest*, ceased publication last month and, as then stated in its columns, the valuable goodwill and connexions acquired by it during the period of its issue have been transferred to this journal. In extending this welcome, we are not without hope that these new friends may find in the pages of *Discovery* the interest which it is our constant endeavour to provide and which is already shared by our wide circle of regular readers.

# Excavations at Lubaantun, British Honduras.

**By T. A. Joyce, M.A., O.B.E.**

*Deputy-Keeper of the Department of Ceramics and Ethnography, British Museum.*

*As the result of excavation at Lubaantun, important new remains of the ancient Maya civilization of Central America have been discovered. The author conducted this work in British Honduras last summer, and expects to start on a further expedition towards the end of this month.*

THE mysterious Maya civilization, which flourished in Central America centuries before the discovery of the New World, has always presented problems of a particularly puzzling nature. Mounds and pyramids of cut stone, huge monoliths covered with intricate carving and long hieroglyphic inscriptions, all fashioned by means of stone tools, imply a numerous population, skilled in artistry and craftsmanship. Yet even the earliest remains so far investigated are obviously the result of a long period of evolution. The art is highly symbolical and conventionalized, the pottery maintains a high standard of technique, yet at present we have no data which could suggest how this great culture originated. It seems to spring full-flowered from the earth, in a definite region on the Atlantic slope, and the remains discovered in the direction of the Pacific are obviously later and degraded reflections of the original centre. Many fanciful theories have been woven to account for this civilization, mostly with utter disregard of the difficulties afforded by the geography of the continent. Those who would believe that the culture was introduced, fully developed, from Asia, forget that they must explain how it is that the bearers of it left no trace of their long journey across the American continent.

GENERAL VIEW OF LUBAANTUN, FROM THE EAST.
The site consists of a triangular hill-spur, the sides of which have been carved into terraces and are also faced with masonry.

As a matter of fact, it is waste of time to theorise, when the answer to the questions involved can be produced by excavation. It is the spade which will decide, so why not get on with the spade-work? It is quite possible that Great Britain may be able to make as great a contribution to the elucidation of American origins as she has already made to those of Greece, Rome, Egypt, and Assyria. Because, by lucky chance, our small colony of British Honduras, a sort of Cinderella among our colonies, contains within its borders remains representing every phase of this Maya culture. It is just a narrow strip of land, about 160 miles from north to south, and about 60 miles from east to west. On the north it marches with the Mexican province of Yucatan; west and south it is enclosed by the Republic of Guatemala; and its long eastern shore is washed by the Caribbean Sea. Much of the country is densely forested, and only partially explored, but the forest veils innumerable archaeological sites which await excavation. In the north of the colony are remains of fine sculpture, dating from the Old Maya Empire, as well as later buildings showing the influence of the Toltec civilization of Mexico. The south provides ruins, at present unexplored, which exhibit certain definite peculiarities, and appear to date from remote times.

The most important of these yet discovered is the site of Lubaantun, some fifty-five miles up the Columbia branch of the Rio Grande, to the west of the little coastal settlement of Punta Gorda, which is marked on most maps. Various reports of ruins in the neighbourhood had been received from time to time, but the first serious attempt to discover the exact nature of the remains was made in 1925, when Lady Richmond Brown, Mr. Mitchell Hedges, and Dr. T. Gann cleared a large portion of the ruins of the dense bush, took a valuable series of photographs, and collected a number of specimens of pottery and

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EXCAVATION IN PROGRESS.
One of the courts on the west side of the hill is being cleared. These were discovered to be entirely faced with cut stone.

stone implements, which were submitted to the British Museum. As a result, an investigation, supported by the British Museum, was planned for 1926, and I was instructed to accompany Lady Brown and Mr. Hedges to assist in excavation.

The trip up the river, which occupies two days and a night, is made in large dug-out canoes, poled by Maya Indians, the descendants, probably, of the early builders. Once the mangrove belt is left behind, the scenery is extremely beautiful. The river winds between high walls of jungle, from which giant trees, many of them in flower, rear their heads; from their branches hang flowering vines and orchids, and clouds of brilliant butterflies dance over every river-beach. It is only from the river that you can really *see* the forest. Once you get inside you are swallowed up in dense undergrowth.

The site of Lubaantun consists of a triangular hill-spur, bounded by two converging torrent-valleys. It measures about 900 feet long by 600 feet broad at the northern end. The top of this spur has been levelled by the early architects, and on it have been erected series of pyramids and mounds, often enclosing courts, and all faced with cut stone. More than this, the sides of the hill have been carved into terraces and also faced with masonry. Thousands of blocks of cut stone have been used in these various constructions, and the labour involved must have been enormous, particularly in view of the fact that only stone tools were available.

Big as the original scheme must have been, there are abundant traces of extensive alterations and additions, extending probably over many centuries. From the preliminary investigations so far made it is clear that in many cases mounds have been enlarged by the simple but laborious process of adding another "skin" of masonry to the entire structure. More extensive, however, are the extensions which have been made to the early hill-terraces. On the western side of the hill the original hill-terraces have been filled in with rough stone and rubble, in order to expand the terraces into courts, and a new masonry coating has been added to the whole hillside.

In the course of the many years which must have been occupied in these constructions and reconstructions, several architectural styles waxed and waned. The most spectacular of the Lubaantun buildings are the two great pyramids, built of white crystalline limestone, and attaining a vertical height of some 45 feet. These are pyramids of the "stepped" variety, and are built in a style which, so far as we know at present, is peculiar to the Lubaantun area. Each second course of limestone blocks projects beyond the course immediately below it, and the shadows, which these projecting courses cast under a vertical sun, give a remarkable "horizontal" effect to the buildings. In the debris at the bottom of the hill-terrace on this side of the site, we noticed several fallen blocks, far larger than those usually employed by the Maya for building. Excavations were made in the terrace above, and we discovered beneath the outer terracing a whole series of earlier terraces composed of huge squared stones, some of them over five feet long. The line of this inner terrace appears to run under the nearest pyramid, and it is clear therefore that the terrace had been filled in and the outer facing of the hillside completed before the pyramid was built. It follows that the peculiar "in-and-out" architecture of the pyramid belongs to a later period than the big stone building of the buried terrace.

In the course of clearing a large mound to the west of this pyramid another interesting discovery was made. This mound was found to contain an inner

CORNER OF A MOUND BUILT IN THE PERPENDICULAR STYLE.
On the left is seen an outer "skin" of masonry that has been added. There are at Lubaantun abundant traces of alterations which were probably carried out over many centuries of Maya civilization.

structure with square corners, faced with perpendicular masonry, recessed backwards every few courses. This mound had been refaced with a coating of masonry in the same style as that of the pyramids. So here, as elsewhere in the ruins, we have a clear indication that the perpendicular style, with its angled corners, preceded the "in-and-out" style with its rounded corners.

Excavation in some of the courts on the western side revealed the presence of early hill-terraces, built in the perpendicular style, but entirely submerged by later building. In some cases the whole hillside has been built out some twenty feet or more from the edge of the original terrace, and furnished with a stucco floor which transformed the terrace into a court.

So far no excavations have been made behind masonry of the earlier styles, and it is a significant fact that the decorated pottery found during the present is in the early Maya style. If, therefore, we have early Maya remains associated with one of the latest architectural periods, there is every hope that the investigation of the earlier buildings will shed much light on the growth, and perhaps the origin, of the Maya civilization.

POTTERY FIGURINES AND PLAQUES IN EARLY MAYA STYLE.
These specimens are of particular interest, since they afford an excellent illustration of the dress and ornaments of these ancient peoples.

The pottery is extremely varied, and ranges from plaques and figurines, made in moulds, to fine painted ware and rough domestic vessels, sometimes decorated by means of stamps. The plaques and figurines are of particular interest, since they afford an excellent illustration of the dress and ornaments of the Maya. Nearly all of them have been furnished with a whistle, with two finger-holes, and so capable of producing three notes. They are of high artistic quality, and were evidently made on the spot, because fragments of moulds were discovered in the course of excavation.

Many of the fragments show hieroglyphs, and at least one gives a date in the Maya script. Unhappily this last specimen is only a fragment, and the inscription is incomplete. All that can be read is "5th day of the month Chen." Stone and obsidian implements were discovered in some numbers, including finely-flaked knife and spear-blades, and small polished axes. Numbers of the stone slabs and rollers by means of which maize was ground (and still used by the Maya of to-day) came to light, but all were broken and had probably been "killed" on the death of the original owner. Shell ornaments, in the form of ear and neck pendants were not uncommon, and two or three beads of jadeite were also found. A peculiarity of the Lubaantun district is the almost complete absence of ornamental stone carving, and this feature differentiates it very markedly from the sites in the north of the colony. One carved block was found in the big stone hill-terrace on the east, but it is crude, and bears little resemblance to the "classical" early Maya style. The terrace itself appears to be one of the earliest structures in the great complex, and it is possible that this carving may be one of the earliest attempts at sculpture on the part of the Maya.

An exhibition of photographs and specimens obtained during last spring has been opened to the public at the British Museum, and the full report of operations on the site is also available there.

Perhaps the most important result of the expedition has been the acceptance of the Trustees of the British Museum of the invitation issued by the colony to undertake the development of its archaeological resources. A further expedition is being planned for this month, and the Trustees, who are contributing to the expenses from funds at their disposal, have invited public subscriptions in support of the scheme. If these funds can be raised, it is intended to arrange for annual expeditions to selected sites. As remarked

above, British Honduras affords a most promising site for the elucidation of the many problems which beset the question of Maya origins, and subscribers will have the additional satisfaction of knowing that their contributions are assisting in the development of a British colony. Contributions should be sent to the Director of the British Museum.

## Progress in Parisitology.

In the course of an interesting survey of "Biology and Human Life" given by Professor Julian Huxley, in the Norman Lockyer lecture of the British Science Guild for 1926, recent advances in the science of parisitology were dealt with. "Given time and a little trouble," Professor Huxley said, "we could make for ourselves a world without centipedes, tarantulas, scorpions, biting insects, and poisonous snakes, as effectively as the United States Health Service has rid the Panama Canal zone of the microscopic organisms of malaria and yellow fever.

"As an example of what may be done in the economic field by intelligent control, we have only to look at the past and present of the gipsy moth. Two years ago I was in the United States, and one day went motoring along Cape Cod. Dead trees were standing everywhere in the woods. My host told me that these had been killed by the gipsy moth. Not only that, but for some years there were no leaves on any tree in all that neighbourhood, and the caterpillars came down, when they had stripped the trees, to eat the grass and flowers. On a still day the woods were full of a sinister rustling—the munching of a million jaws, and rattle of the million pellets of undigested food continuously extruded by the destroying army. Hundreds of thousands of dollars a year were spent by the State in spraying and other curative measures; but with only meagre results. Eventually biology came to the rescue. Entomologists studied the gipsy moth in its original home and discovered just what natural enemies it had there. They imported these enemies—a beetle that devours the eggs, another, larger, which attacks the caterpillars, and a hymenopteran whose brood, deposited as eggs in the caterpillar, devours the growing animal from the interior. These keep the gipsy moth in check, so that to-day the countryside is green again, and the moth, though not exterminated, is become only a minor annoyance. Without the meticulous knowledge of the ways and life-histories of a thousand and one apparently useless beetles and flies and moths, amassed often just for the sake of knowing, such control could never have been accomplished.

"Let us take one other example. The prickly pear was introduced into Australia as a botanical curiosity, and specimens presented to settlers' wives by well-meaning authorities. Within a few decades, the pest, finding itself in a country to which it was admirably adapted, and what is more, finding itself there without any of its natural enemies, had multiplied until it covered thirty million acres—nearly fifty thousand square miles, or in other words nearly the area of England. Not only that, but its rate of increase, though as a percentage modest, was conquering another million acres a year for itself—nearly two acres a minute! All efforts at control proved useless. A few effective methods of chemical control were found, but all were impractical owing to their prohibitive cost.

"Great and not unnatural prejudice had been shown against any attempt to introduce insect enemies of the pest for fear that, like the mongoose in the West Indies, they might change their habits, and the remedy prove worse than the disease. However, when all other methods had failed, this prejudice broke down, and trained entomologists were sent to the native homes of the prickly pear in America to collect its insect enemies. As a result, two species of cochineal insect were introduced into Australia and liberated, and are now bringing the increase of the pest within bounds. Search for other insect enemies is proceeding, and Australia is looking forward not, as she was some years ago, to having a large part of her area permanently occupied by the troops of her vegetable enemy, with a few railways and walled towns holding out in the spiny desert, but to a gradual winning back of all that has been lost. It is interesting to note that the cochineals were only liberated after the most elaborate tests had proved that they would eat nothing but prickly pear."

## New Coal Distillation Process.

The discovery of a new process for obtaining oil from coal was announced by the German Dye Trust on 14th December. According to *The Times* the following statement was issued by the company:

We have discovered, patented, and developed a coal distillation process of our own, and we are convinced that, unlike the processes hitherto known, it will pay. Our process is an independent development on the basis of knowledge obtained by us. As, however, our process rests to some extent on the fundamental work of Dr. Bergius, we have also secured the Bergius patent for lignite in Germany exclusively, and have made possible the use of hard coal by acquiring a considerable interest in the Kobergin A.G. Abroad, the I.G. has acquired a considerable interest in the International Bergin Company of The Hague, which owns the Bergius patents outside Germany.

# Human Speech and Its Artificial Production.

**By Sir Richard Paget, Bart.**

*The principles of human speech, in particular as illustrated by its artificial production, were the subject of a lecture in London some weeks ago by the author, who here describes the application of apparatus he has invented for the practical demonstration of phonetics.*

HUMAN speech is always associated in our minds with its sounds; yet sound is by no means an essential of language, since deaf mutes, who have no conception of sound, can be taught to understand speech by observing the movement of the organs of articulation, principally the tongue and lips, etc., of the speaker.

On the North American continent there was, until lately, a single silent gesture language, which was used by the various tribes as a means of communication between those who spoke different languages. We ourselves still use silent gestures, such as a nod, a wink, or a shrug of the shoulders, as an addition to, or substitute for spoken words. Essentially, human speech is a complicated semaphore code, made with the organs of articulation, as a means of expressing our thoughts. These movements of the tongue, lips, etc., produce changes of resonance when we blow air through our vocal cavities and, when we listen to audible speech, we unconsciously reconstruct in our minds the movements which produced the sounds and so, eventually, get a mental impression similar to that intended to be conveyed by the sender of the message.

### Symbolic Gestures.

The various forms of writing are only another kind of gesture language; the symbolic movements of the hand being made to leave a spoor or track, by the use of an implement of some kind, by which the original movements can be identified, just as a skilled tracker can reconstruct the experiences and even the emotions and intentions of a traveller through the snow, by means of the tracks he leaves behind him.

The symbolic gestures of writing have been based on many different principles. In Egyptian hieroglyphs, writing is mainly based on the direct representation of natural objects. In the Chinese ideographic system, writing is based on the representation of all ideas (quite apart from sound) by the combination of simple symbols, which represent each a simple idea. Here we have another form of universal gesture language, by which the various Chinese nations, speaking different languages, can understand one another in writing, since the writing represents ideas that each nation describes in its own language. In modern English and European spelling, the hand gestures recorded in writing are intended to represent the sounds which are due to the original symbolic gestures, made by the organs of articulation. Spelling is, in fact, the most "roundabout" of all methods of recording human thought.

### The Mechanism of Speech.

The mechanism of human speech consists, as is well known, of the lungs, the vocal chords, and the cavities of the mouth and nose. The lungs are only a bellows for providing the air supply at the required pressure, volume, and time. The vocal chords form double doors to control the air traffic from the windpipe into the mouth and the cavities of the mouth and nose. The action of these cavities is controlled by three separate valve mechanisms, namely, of the soft palate which acts to open or close the passage to the nasal cavity; the tongue, by which the passage of the mouth can be closed, in whole or part, in any position between the back of the soft palate and the teeth; and the lips, which form the front door of the vocal cavity and operate to close it, in whole or part, to the outer air.

What happens, when air is blown through any of these cavities is that the air inside the cavity is disturbed and, being elastic, begins to vibrate and palpitate, at a rate which depends on the size of the cavity and size of the opening or openings of the cavity. The action is similar to that of the air inside an ocarina, and it has this peculiarity, that the rate of vibration of the air does not depend simply on the size of the cavity, but on the relation between the size of the cavity and the size of its openings. It is for this reason that children with smaller vocal cavities can still speak with the same pronunciation as their elders.

The effect of the vibration or resonance of air inside the cavity can be illustrated by the device known as a Helmholtz resonator, which can be made to yield its natural note, either by blowing air through the resonator to produce a faint, "whispered" sound, or by driving sharp puffs of air through the resonator to produce a louder, instantaneous popping sound, or by blowing air across the mouth of the resonator

to produce a loud continuous musical note. Any cavity of about the size of the human mouth, and of which the breadth is relatively large as compared with the length, behaves in the same way—which is essentially different from that of a tube.

A musical instrument of a sort can be made by the hands, namely, by closing the fingers so as to form a cavity, with a variable opening made by the thumb and first finger. If the edge of the palm and little finger of this hand is clapped into the palm of the other hand, a musical popping sound is produced, of which the pitch can be varied by variations of the size of the cavity or of the size of its opening. In the case of the human mouth, each separate cavity which is formed during movements of articulation produces a resonance of its own. Thus in forming vowel-sounds, the tongue is moved into a particular position for the production of each vowel. In this position the tongue acts as a partial closure, so placed in the mouth as to divide the cavity into two separate resonators, namely, the resonator in front of the tongue and the resonator behind the tongue, with a constriction or waist between the two cavities. Each tongue position, therefore, gives rise to two separate musical resonances which we hear as a vowel-sound. When the vocal chords are separated, so that the air from the lungs flows as a continuous stream through the vocal cavities, we hear a whispered vowel; when the vocal chords are brought together, so that they can chop the air stream up into a succession of sharp pulses, we hear a voiced vowel-sound.

Fig. 1.
PLASTICENE MODELS USED FOR ARTIFICIAL PRODUCTION OF VOWEL SOUNDS.
These resonators are here seen mounted on the late Lord Rayleigh's experimental organ at the Royal Institution in London. The vowel sounds produced, indicated by the phonetic symbols on the models, correspond, from left to right, to those in the words:—it, men, earth, up, calm, not, no, and who.

The resonances of the vocal cavities, when we set them to produce the different vowels, can be made audible by tapping the throat—so as to disturb the air inside it, or by driving puffs of air into the mouth by a clapping action, so as to make a musical popping sound. In this way it can be shown that the two resonances can be separately controlled and even made to execute scales in contrary motion.

The pronunciation of each individual depends on the tuning of his or her vocal cavities, so that by recording the resonances used by a speaker we can actually record their pronunciation.

The vocal chords have nothing to do with articulation, since all English speech can be clearly produced as a breathed or whispered effect, without using the vocal chords. The use of the vocal chords is threefold:—

(1) To increase the loudness and audible range of the vowel-sounds—the actual range may be increased anything between 10 and 20 times, as compared with the corresponding sound when whispered;

(2) To allow of the raising and lowering of the pitch of the voice, so as to give the emotional and explanatory effects of vocal inflexion, as when we raise our voice at the end of a sentence to indicate a question;

(3) To produce the effect of melody, as in song.

That the humming sounds produced by the vocal chords are independent of the musical resonances produced by the vocal cavities is easily shown by the performance of humming and whistling simultaneously. The pitch of the whistled note depends on the resonance of the cavity made between the tongue and lips.

Experiments made with cavities, formed of plasticene (as shown in Fig. 1) and tuned, by adjustment of their capacity and size of opening, so as to give the same resonances as those heard in the speaker's voice, showed that whispered and voiced vowel-sounds could be artificially produced by blowing air through the cavities. They also showed that the exact shape of the cavity was not of primary importance.

Similar effects were produced by the use of cylindrical cavities of relatively large bore, divided into two resonators by means of a cork "tongue." In these models the place of the vocal chords was taken by an ordinary organ reed, which operates to chop up the

air supply into a succession of rhythmical puffs, much in the same way as is done by the human vocal chords.

From the gesture point of view the vowels are produced by *postures* of the tongue and lips. The diphthongs are produced by *gliding gestures* of the tongue from one vowel posture to another. The consonants are essentially due to the *gestures* of the organs of articulation which precede or follow the vowel postures.

### The Formation of Consonants.

In the formation of the consonants one or other of the three valves (made by the tongue, the soft palate, or by the lips), is either completely closed or nearly closed, at some stage of the gesture. The complete closure and release produces a sudden starting or stopping of the resonances with a snap. It is in this way that the so-called plosive consonants, such as p, t, and k are produced. The difference between them is due only to the differences of resonance which are set up when the closure and release are made at a different position in the mouth cavity.

The partial closures give sibilant or whistling sounds, like those of th, f, s, and sh, or their voiced equivalents (when a vocal hum is added), dh, as in then, v, z, and dz.

The consonants, like the vowels, are due to resonance and like them are essentially musical effects, and can be imitated by models, which produce similar changes of resonance. Thus, a tubular model, with a tubular nasal cavity added, can be made to give the sounds " m " and " n " and to pronounce the name " Minny " with the nostril open, or " Biddy " with the nostril closed—as when the speaker is suffering from a cold in the head. In the same way a model with a resonator consisting of a rubber tube, can be made to articulate most of the consonants by pinching the tube in the appropriate positions to produce the necessary total or partial closures. Spoken words and consonants can be artificially produced by the Cheirophone, in which the speaker's hands form the resonating cavity, while three fingers of one hand are moved together to form a tongue.

Considered as a means of symbolising human thought, all present languages are still very imperfect, which is not surprising, when it is realized that they have grown up without conscious guidance. The flowers of human speech are still all wild flowers, however ingeniously we may use them. Human speech probably grew up by the development of gestures, made by the organs of articulation, in substitution for gestures made by the face, hands, and arms. Such descriptive gestures are still to be found in human speech, such as the use of a small cavity made by the tongue and lips to indicate smallness, and a large cavity made by withdrawing the tongue to represent largeness. Hence the words " wee " and " near," produced by a small front cavity, or a forward position of the tongue, and " huge " and " far," produced by a large cavity, or a retracted position of the tongue, in English, and the corresponding French words " petit," " ici," on the one hand, and " grand," " la bas," on the other.

The perfect language would have a separate gesture symbol for each separate idea, and the order of the symbols would strictly follow the logical order of the thoughts which they expressed. English is probably the best language yet developed by man, but it is still far from perfect and in need of further improvements, if it is to be made a really efficient vehicle for human thought.

Above all, there is needed an improvement in the system of recording English in spelling. The most practical way of preparing for this, in the writer's opinion, would be to ensure that all children are taught in the first instance to read by the phonetic method of the International Phonetic Association. In this way the learning of reading becomes extraordinarily easy. A generation who have been taught in their youth the advantages of the phonetic system, will be ready, when their time comes, to substitute a scientific system for our present anomalous and pedantic spelling. As for ourselves, we ought to resume the liberty which Chaucer and Shakespeare enjoyed, namely, to spell as we please.

## Acoustics in Building.

THE prediction of the acoustic properties of a hall before it had been constructed has been held to be impossible, but research carried out in the United States, Germany, and later in this country, has made it possible to lay down certain general principles to guide the architect in designing buildings so that their acoustic properties shall at least be reasonably good. With the aid of models the passage of the sound waves to and fro across the hall is recorded photographically, and the effect of the waves as reflected from irregular projections can be seen in this way. A series of such photographs was shown recently at the Science Museum, South Kensington, by the National Physical Laboratory, at the first of a new series of exhibitions which will be changed about three times a year, so that various research institutions will have the opportunity of attracting popular notice to their discoveries.

# Sea Ivory in Old Wales.

**By Colin Matheson, M.A., B.Sc.**
*Zoology Department, National Museum of Wales.*

*New light on the early history of whaling is contained in a reference to the game of chess discovered by the author in an old Welsh code of laws. Interesting conjectures depend on whether the chessmen were made of bone or ivory.*

" And there we hunted the walrus,
The narwhale and the seal ;
Ha ! 'twas a noble game !
And like the lightning's flame
Flew our harpoons of steel."
—*Longfellow.*

LITTLE information is available, especially so far as actual documentary evidence is concerned, as to the early development of the whaling and allied fisheries in Europe. Isolated facts crop up here and there: for example, we deduce from an old ecclesiastical manuscript that whales were hunted with harpoons off the Flanders coast as early as the last quarter of the ninth century, while one of the earliest uses of whalebone — for making plumes for helmets — is mentioned by William le Breton in the thirteenth century. A fair amount of data is available regarding the whale fishery conducted by that remarkable people, the Basques, from the tenth century onwards. " We know," says one investigator, " that from the tenth to the sixteenth centuries the Basques . . . were carrying on a lucrative trade in the products of a whale industry conducted by themselves, which supplied Europe with whalebone and oil." The Norwegians also had a whaling industry which, according to some, antedated even that of the Basques. From the references to the hunting of whales and other marine mammals in King Alfred's narrative of the voyage to the White Sea by Ochther, who presented the English King with the famous " walrus tooth," it would seem that this perilous pursuit was carried on in the far northern seas to a considerable extent even at that early date. Scottish fishermen also appear to have taken up whaling—in 1290 one-fifth of the provisions supplied to a ship fitted out at Yarmouth, for bringing home the young Queen of Scotland from Norway, came from Aberdeen, and included among other things fifty pounds of whale.

FIG. 1. [*Photograph by Miss C. M. Acland.*
RORQUAL WHALE STRANDED ON THE COAST AT PORTSKEWETT, MONMOUTHSHIRE.
Whales are not common in Welsh waters. In their journeys they may be deflected, to some extent, from passing through St. George's Channel by the projecting coast-lines at both ends of that channel.

We have also still extant various objects carved at an early date from the bones or teeth of marine mammals. There is, for example, the famous Franks Casket, often thought to be of ivory, but in reality carved from the skeleton of a whale ; this may possibly date from the early years of the eighth century. In the Mayer collection in the Liverpool Museum there is a Nativity of walrus ivory, showing the influence of the Winchester school of illumination which flourished in the tenth and early eleventh centuries. In the British Museum is a whalebone panel of the ninth or tenth century, carved with David dictating his psalms, and also a series of twelfth-century draughtsmen of walrus ivory. Among the oldest chessmen extant are some from the Isle of Lewis, also made from the ivory of the walrus, and dating from the twelfth or the thirteenth century ; these too are in the British Museum.*

When all is said, however, our knowledge of the early

* I am indebted to Dr. R. E. Mortimer Wheeler and Dr. Cyril Fox for drawing my attention to some of these early specimens.

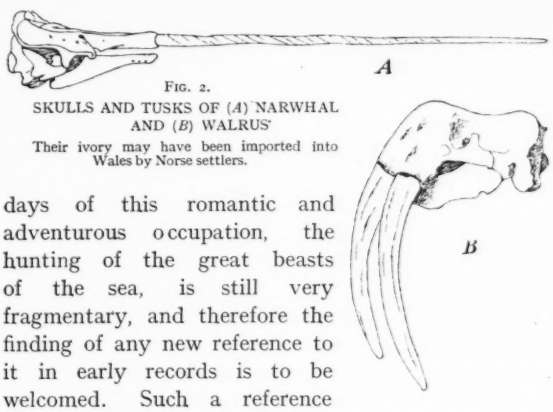


FIG. 2.
SKULLS AND TUSKS OF (*A*) NARWHAL AND (*B*) WALRUS
Their ivory may have been imported into Wales by Norse settlers.

days of this romantic and adventurous occupation, the hunting of the great beasts of the sea, is still very fragmentary, and therefore the finding of any new reference to it in early records is to be welcomed. Such a reference which has never, to the author's knowledge, been noted or commented upon in accounts of the whaling industry, is to be found in the code of laws drawn up by the Welsh King Hywel Dda, in the early part of the tenth century.

Hywel Dda (Howell the Good), who has been often compared with the Saxon King Alfred, "seeing the Cymry perverting the laws," summoned a council of the wise men of the nation to emend and codify the ancient Welsh laws. The resulting legal code is generally called by his name; as we have said, it was compiled in the first half of the tenth century, though the various manuscripts extant are of rather later date. The point in these laws to be dealt with by the writer involves a certain amount of philological discussion for which he must ask the patience of his readers.

There was a game called tawlbwrdd, which, to judge from the laws of Howell, would seem to have been of some importance in the Welsh social life of the time. Tawlbwrdd is translated in the Welsh-English dictionaries by chessboard, or draughtsboard, and was also used to denote the game itself, *e.g.*, chwareu tawlbwrdd, to play chess. It was played, we are told, with a black king and eight black men against sixteen white men. The tawlbwrdd was also used, for some reason unknown to us, as a symbol of justice.

Now we read that "the judge of the court" was to have certain presents when his office was pledged to him. These included "a tawlbwrdd of the ivory of a mormil" (literally a sea-beast), "from the king, and a gold ring from the queen." The king's bard was also to receive a tawlbwrdd of the same material. In yet another passage the tawlbwrdd of a freeholder is stated to be worth "if it be of the ivory of a mormil, three-score pence. If it be of the antler of a hart, twenty-four pence; if it be of the horn of an ox, twelve pence; if it be a wooden tawlbwrdd, four pence."

The Welsh phrase "asgwrn mormil," which the writer has translated as "the ivory of a mormil," is usually rendered, in the English versions, by "the bone of a whale." But it is clear that the bones of a whale would yield a chess outfit superior neither in appearance nor in any other way to that made from the bones, say, of a horse or an ox. The comparatively high price fixed for the first type of tawlbwrdd in the above list, and the fact that those officially presented to the judges and the bard by the king were to be of this material, indicate clearly, in the author's opinion, that it was something of value and of distinctive appearance. In this conclusion he is borne out by the most recent Welsh and English dictionary, which gives "asgwrn morfil" and "asgwrn eliffant" respectively for the ivory of marine mammals and the ivory of the elephant.

The word "morfil" or "mormil" is used in Wales to-day to denote definitely a whale; every other

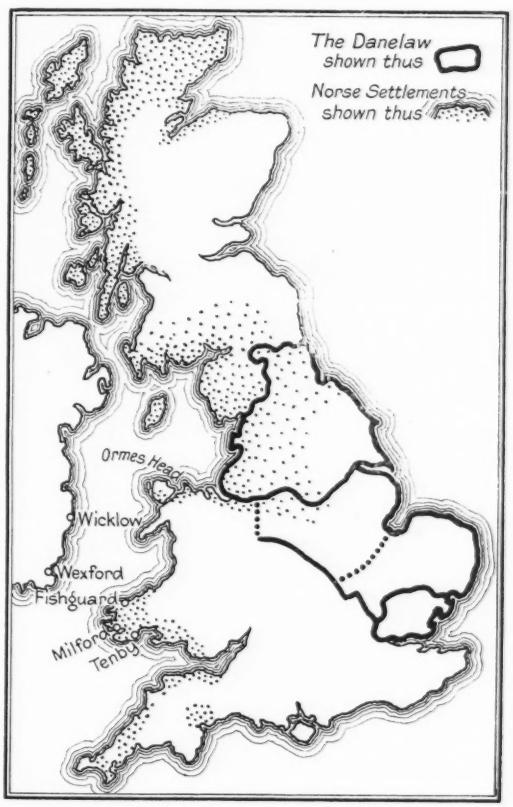


FIG. 3.
MAP SHOWING NORSE AND DANISH SETTLEMENTS IN BRITAIN.
Vikings from Ireland and elsewhere were among the settlers in South Wales, where Norse place names still survive.
(Adapted from maps in Taylor's "Words and Places" and Collingwood and Powell's "Scandinavian Britain.")

type of marine mammal having also a definite name of its own. In Old Welsh, however, as with similar words in Old English, the meaning was not so definite, "morfil" being used archaically to include also the narwhal and the walrus. What seems to be clear is that—whether the Welsh phrase refers to the bones of the whale or, as is much more likely, to the ivory of the walrus or the narwhal (Fig. 2)—we have here one of the earliest references in law to the use of the products of the marine mammals.

As regards the narwhal and the walrus, they are both creatures of the far Arctic seas. It is most improbable that specimens of the former, an essentially Arctic animal, can ever have been washed ashore on Welsh coasts, nor was the walrus likely to be at all often thus obtained; for although persecution has been gradually driving it northward, yet within the historic period it does not seem ever to have come farther south than Finmarken, in the extreme north of Norway. As regards whales in general, though specimens are sometimes washed up (Fig. 1), comparatively few are harboured in Welsh waters—Southwell, in his observations on North Wales, remarks that the district is "singularly devoid of cetaceans."

Yet the inclusion in Howell's laws of a tawlbwrdd of this "ivory" in the list of a freeholder's household furniture suggests that it was, though valuable, yet well known and not very uncommon. One is greatly tempted to suggest importation by the Norsemen, especially in view of the strong Norse element in these islands at or near the date under consideration. England, Scotland, Ireland, and Wales were all familiar with the northern rovers. In Scotland they formed the main bulk of the Scandinavian element in the population. In the north of England too they were to be found, interpenetrating the kingdom established by their cousins the Danes, and also so far south as Devon and Cornwall. As regards Wales, they seem to have formed settlements in various parts of the Principality; Norse place-names in Gower, and more particularly in Pembroke, testify to this in South Wales, and similar names occur, though less plentifully, in the north (see Fig. 3). There is also abundant proof, say Collingwood and Powell, that the Vikings in Ireland were in constant touch with the coast of Wales.

The idea that the material for the chess game of the Welsh was supplied by the Norsemen receives additional support on etymological grounds. The writer is informed on good authority that the Welsh "tawlbwrdd" is probably simply a modification of the old Norse "taflbord," chess or draughts.*

* That of Dr. D. R. Paterson, who has made a special study of Norse names in Wales.

Mention has already been made of the chessmen of walrus ivory from the Isle of Lewis, of Viking origin and presenting "in a vigorous style Scandinavian physical types of the twelfth century."

We cannot, of course, say definitely whence the Welsh obtained their material, but it is interesting to find, from these three distinct references in Howell's laws, that certain products of the cetaceans or marine carnivores were familiar in Wales at such an early date.

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## Researches on Fruit.

In the report for 1925-6 just issued by the Principal of the Imperial College of Tropical Agriculture, Dr. H. Martin Leake, reference is made to research now being undertaken at Trinidad on the problems of fruit. It is pointed out that the year has been characterized by the appearance of the Fruit Report—the result of the deliberations of the Imperial Economic Committee—and that among the recommendations made is that investigatory work on bananas should be developed by the college. The importance of securing a banana immune to Panama Disease remains a prime consideration. The giant fig maintains its reputation for immunity, and arrangements have now been made for its extended cultivation, the College growing one acre. The question of its carrying capacity has still to be answered. Trial shipments have not proved satisfactory for this purpose. One of the main factors is temperature, though humidity and gases are also of importance. It is well known that even closely related varieties of fruit may differ markedly in their response to these factors, and preliminary attempts have been made to ascertain the temperature optimum for the giant fig. Action to secure other immune varieties by means of raising seedlings is being continued at Trinidad, but inevitably time must elapse before results can be obtained. With regard to field work an area of fifteen acres is now under experimental cultivation on the college estate proper. It is hoped, however, that before long a further property will have been acquired which will offer full facilities for the study of tropical agriculture in all its branches. Apart from such facilities, the college is situated within easy access by rail or road to local estates.

# New Light on the War Crisis of 1875.

**By R. B. Mowat, M.A.**

*Fellow of Corpus Christi College, Oxford.*

*Whether the strained international situation that arose in Europe in 1875 was in fact a serious crisis has until lately been a matter of some doubt among historians. Light on the problem is forthcoming from the recently published "Letters" of Queen Victoria.*

THE Franco-German War of 1870-71 ended with a tremendous decline in the power of France, and with the establishment of the immensely powerful State of the German Empire. France was weakened by the loss of Alsace-Lorraine, by the five milliard indemnity, and perhaps most of all by the blow which her morale sustained in the defeat at Sedan and the capitulations of Metz and Paris.

The spirit of France, however, was unconquered; and within a few years she had made a marvellous recovery. The Republican institutions established after the fall of the Imperial régime became consolidated in the confidence of the people and provided a stable system. The indemnity to Germany was paid off, industry recovered its prosperity, reforms and increases were brought into force in the army. This revival, which was in the highest degree creditable to the French, seemed to please everybody in Europe except the Germans. The diplomatists of the Wilhelmstrasse believed or affected to believe that France was again becoming a danger and was meditating a war of revenge. They began an agitation out of which a regular war-crisis appeared in 1875.

The crisis was very famous in its time. It caused consternation at Paris, London, and St. Petersburg. The prospect of a renewal of European war was frightful, coming as it did while memories of the Franco-German War, the *anneé terrible* of France in 1870-71, were still fresh in everyone's mind. France, marvellously revived though she was, could not have withstood the mighty German military machine; and this time her defeat would have been final. However, after a period of intense agitation, the crisis subsided, after the Russian and British Governments had intervened in the cause of peace.

Such is the celebrated crisis. But in a comparatively recent authoritative volume of history ("Histoire de la France Contemporaine") M. Seignobos has thrown doubt upon the reality of the crisis. He says that the diplomatists of Europe form a "great village," *un gros village*, and that gossip and rumours are spread about and magnified out of all proper proportion. This was the view which Bismarck himself took or affected to take, when the crisis was over. "People have been trying to embroil us," he remarked in his genial, frank way, to the French ambassador. Count Max Montgelas, in his book on war-guilt published two years ago ("The Case for the Central Powers") likewise pooh-poohs the "crisis" of 1875. But the recently published volumes of Queen Victoria's Letters* show that it was a real war crisis, and that the Queen and the Tsar played a very effective part in stopping it.

In May, 1875, M. Nothomb, the very acute and observant minister of Belgium at Berlin, reported to Brussels some rather alarming conversations with Bismarck, who complained of the increase of the French army, and affected to believe that France was going to march through Belgium. Lord Derby, Secretary of State for Foreign Affairs, was informed of these conversations, and wrote to the Queen about them.

### Queen Victoria Intervenes.

On receiving this intelligence, Queen Victoria at once conferred with the Prime Minister. On 6th May, she wrote in her Journal :—

Saw Mr. Disraeli and talked about the very alarming rumours from Germany as to war. This began by dictatorial and offensive language to Belgium, then by reports of the Germans saying they must attack France, as she threatened to attack them, and a war of revenge was imminent, which the increase in her armaments proved. I said this "was *intolerable*, that France could not for years make war, and that I thought we ought, in concert with the other Powers, to hold the strongest language to both Powers, declaring that they *must not* fight, for that *Europe* would *not* stand another war!" In fact, Mr. Disraeli said, Bismarck is becoming like the first Napoleon, against whom all Europe had to ally itself.

The Prime Minister, Disraeli, urged the Queen to use her personal influence. It was a great advantage that the monarchs of Europe all knew each other. They formed what the Italian historian Ferrero has called an "International," a European society, the members of which called each other brother and sister, and freely exchanged letters. Queen Victoria, who

* "Letters of Queen Victoria." 1862-78. Edited by G. E. Buckle. (London: John Murray).

had great personal prestige with her brother sovereigns, often intervened in a friendly way, during continental crises. Accordingly, Disraeli on this occasion advised the Queen to write to the Emperor of Russia, in order to induce him to combine with her in pressing peace upon the German Emperor. At the same time Lord Odo Russell, Her Majesty's Ambassador at Berlin, was instructed to make urgent representations to Bismarck.

### Bismarck's Ill-health.

On 9th May, Lord Derby had an interview with Schouvaloff, who said that the Emperor of Russia was prepared to speak very decidedly at Berlin, "and that the Austrian Government was prepared to hold the same language." Lord Derby also imparted to the Queen: "From what Schouvaloff told me it is clear that Bismarck has been warning the Russians against us, and us against them. That little game has failed." There is no doubt that Bismarck, who had at this time wretched health, was greatly excited about France. Lord Derby, in the same report to the Queen, said that Schouvaloff seemed to consider Bismarck to be in a morbid state of mind. Bismarck, so Schouvaloff said, could not sleep, and complained much of his health. He was extremely nervous, and believed—or affected to believe—that all Europe was combining against Germany; and for himself, he was "haunted by the idea of assassination."

A disquieting feature of the situation was that the old Emperor William, who was peacefully inclined, seemed to be quite unaware of all this alarm. Bismarck did not give him the dispatches to read, and sent instructions to the German diplomatic agents without consultation with the Emperor. There is no doubt that there was a military party which was speaking about war. Schouvaloff told Lord Derby that the idea in the minds of the militarists was: "We must attack before we are attacked." This is the theory of the *preventive war*, which so often appears in the literature of war-guilt and in the controversies concerning the origin of the war of 1914-1918.

Meanwhile the Queen had written (10th May) to the Emperor of Russia. Her son, the Duke of Edinburgh, was married to Marie, the Emperor's daughter. The Queen took the opportunity of giving the Emperor news of Marie and of the Prince, who had both been lately on a visit to her. Then she added: "I cannot end this letter without expressing the firm hope that you will use your great influence to try and maintain peace, and to dissipate the profound alarm which the language held at Berlin has excited in all Europe." The correspondence of the Queen and Emperor was always written in French.

The Emperor of Russia was at this time travelling in Germany. He met Bismarck, and urged him to be peaceful. Lord Odo Russell was doing the same thing. Bismarck showed himself ready to be persuaded, and gave all the assurances that were desired. The truth is that he could not afford to act against all Europe. The Emperor of Russia then wrote (18th May) to Queen Victoria, thanking her for the news of his daughter, and adding that he had seen both Bismarck and the Emperor of Germany, and had not found his task difficult: for "they knew that France was not in condition to think seriously of revenge for some years." Also Austria had supported the views of the Tsar: "We can hope that the alarm spread by rumours of a new war will not be slow to disappear, all the world having need of peace."

So the war-crisis passed away. Was it ever really serious? A letter of the Crown Prince of Germany, a perfectly honest and liberally-minded man, seems to answer this question. He wrote (24th May) to Queen Victoria assuring her that Germany had had no intention of attacking France. He added:—

I am afraid we shall never accurately find out who is in reality to be blamed for getting up these alarming rumours. But I could not help observing that perhaps our Chancellor himself, from his state of nervous irritation, might sometimes be induced to utter remarks, which are liable to be misconstrued and are often interpreted as meaning more than they were originally intended to mean. However, it cannot be denied, that in our military circles there may be found several high lords who do not conceal their individual longing for war, and therefore suggest a resumption of hostilities against the still enfeebled foe as a measure of political wisdom. Thank God, however, these persons are not in supreme power and, though some of them may enjoy a certain amount of authority, yet my father will always represent a policy of common-sense and moderation.

### An Explanation.

Unfortunately the old Emperor William did not know what was going on. Bismarck had a policy of his own, and simply did not show foreign dispatches to the Emperor. On 23rd June the Emperor wrote to Queen Victoria stating that he certainly never meant to attack France. If highly-placed German soldiers or officials had spoken of such a thing, he (the Emperor) had known nothing of it. "As" (he wrote to Queen Victoria, in reply to a letter of hers) "you mention no names, and say it is unnecessary to go back to what is past, your communication will serve to make me more watchful and to preach prudence on every side."

# The Universities of the United States.

By Sir Arthur Shipley, G.B.E., F.R.S.

*" Discovering American University Life " was the title of an article in our November issue by a Cambridge undergraduate, while last month a Harvard student contributed similar impressions. The present article discusses the status of the universities themselves ; Sir Arthur Shipley first visited America some forty years ago, and was Chairman of the British Universities Mission during the last three months of the war.*

THE universities of the United States are so numerous and so diverse, that it is difficult to find any feature which is common to them all, except such features as are common to Universities throughout the world, as a library, a chapel, lecture rooms, and playgrounds.

The American Universities may be divided according to the foundation into those that are especially connected with various religious denominations, those that are State Universities which have no leaning to one sect or another and where religion is not officially recognized, and those that have been founded by individuals. The three early Universities—Harvard, William and Mary, and Yale—were more or less founded on the English College system, and whereas Harvard has always had a leaning towards Unitarianism, Yale has been connected with the Congregational Church, Columbia with the Episcopalian, Princeton with the Presbyterian, Rutgers with the Dutch Reformed Church, and Brown with the Baptists. Apart from these there are special Catholic Universities which have the utmost freedom in the various States. Washington University in the Federal capital was created by the Pope, and there the hierarchy of the Roman Catholic Church is dominant. Every State now has its own State University, and these are open to men and women alike, and these institutions have very considerable freedom under the State laws. Such Colleges as Cornell, the Johns Hopkins at Baltimore, Tulane at New Orleans, Clark Leland at Stanford, have been all endowed by one person or by a small number of people. They are independent of State control, and show little if any denominational character. It might have been thought that the establishment of the State Universities which has steadily proceeded in the last fifty years would interfere with the privately founded and more denominational institutions, but this has not proved to be the case. Each has been a stimulus to the other.

The body which controls education at Washington has no control over the education of the various States. There is no co-ordinating body. At best the Federal authorities are occupied with recording what is taking place and issuing reports, often of considerable value, but with no power behind them.

Thus it has come about that the term University is a very wide one in the States. The late Lord Bryce told me that once when he was travelling in the Middle West he met on the cars the President of a University. He asked him what was the size of his staff, and the answer was " At present it consists of myself and my wife, but we hope to add to the number shortly." It is this freedom which allows anyone to start what he calls a University that has led to the sale of degrees and various other scandals connected with these bogus institutions.

### Colleges—Small and Large.

One of the difficulties that one is faced with in considering an American University is the word College. This may denote a department in a big University, or it may denote a separate establishment which cannot give degrees higher than the B.A. and M.A., and where no professorial faculties, such as a Medical or Law School, exist. Many of these so-called colleges have but five or six hundred students. Hence these receive far more individual attention than the students at the greater University ; and this accounts for the fact that places like Clark and Amhurst and Brown have a higher percentage of men who become distinguished in after life than have the larger institutions. Many of the latter have become almost unmanageable by their size ; 16,000 and 18,000 students may be congregated together. One of my friends who is a Professor of Philosophy has a class of 1,400-1,600 students, and since there is no lecture room capable of housing such a throng, he has to lecture in the open through a loud-speaker. Fortunately his University is situated in California. Most of the State Universities and many others do not encourage the study of theology. Hence this subject is generally relegated to such institutions as the Union Theological Seminary in New York. Until quite lately Princeton, which is perhaps the most aristocratic of all the Universities, and whose numbers are strictly limited and which is absolutely a male University, did not claim the title of University. But the establishment of the magnificent post-graduate

school for classics under Dean West gave it its claim to a Charter. A certain number of the Universities have medical schools attached to them, and many have highly-developed schools of dentistry; in fact, America is the training ground for dentists all over the world. The medical school is very often some distance from the central buildings. At Harvard, for instance, it is in the centre of the city of Boston, whilst Harvard itself is in the neighbouring city of Cambridge; at the North-Western University at Chicago the medical and legal schools are in the heart of the city, whilst the rest of the University is at Evaston, some fifteen miles along the lake shore.

We have mentioned libraries, but in American Universities the library is far more than a storehouse where books and MSS. are preserved and consulted. Connected with the building are a number of Professors' rooms where the Professor takes small classes, or holds what they are fond of calling "seminars"; and there at certain times he will direct his pupils as to the books most suited for their needs. Access to the shelves, which is such an invaluable privilege at the older Cambridge, is denied them, but if you happen to know the name of the book desired, the librarians are able to produce it in an astonishingly short period of time.

**European Influence.**

During the last half of the nineteenth century a considerable number of teachers came from Europe, and with them brought a much wider outlook than had hitherto prevailed in the States. The influence of the Germans became very marked, and the cheapness with which they distributed their Ph.D. degree to the American students attracted a return current of young men to the Old World. In America there is no central recognized authority, and the value of the degrees varies greatly in the varying seats of learning. Neither law, tradition, nor public opinion exercise anything but a small amount of restraint. Every college is a law unto itself. Yet that this want of uniform standard is recognized is shown by the fact that every Christmas there is a meeting of Deans, generally the senior Dean of each college represents his University. The Deans are to all intents and purposes the heads of the faculties. At this meeting the claims of every teaching body are carefully revised, and they produce a list of some 400 or more institutions which in their opinion are of repute. They are also said to take up a considerable amount of time in discussing their respective Presidents. In admitting American students to Cambridge or Oxford this list provides some sort of guarantee that the candidate represents a reputable institution.

The question of co-education is one about which opinion differs very widely. Columbia, Harvard, and Yale have women's colleges connected with the University. But they are not on the same footing, and in some cases do not attend the same lectures as the men. In all the State Universities the sexes are absolutely equal. Princeton stands out and has nothing to do with co-education. As a rule, travelling round the various University towns one finds that whereas a very large majority of women are passionately in favour of co-education, the majority of men, whilst recognizing that it has come to stay, regret it. There are, of course, many separate women's colleges, such as Vassar, Smith, Wellesley, and Bryn Mawr, where faculties are on a very high level and the accommodation is on the most ample scale. At Vassar there are more acres in the Campus than there are lady students in the institution. At none of these Colleges are men admitted, thus the ladies push their way into men's preserves, but most successfully conserve the inviolability of their own. The Johns Hopkins University at Baltimore stands alone. It was founded and for many years remained as a purely research University with a very few undergraduates, and these only from the town. Later its revenues declined and it was forced to take in undergraduates. But last year it was decided to revert to the original intention, and in future no more B.A. degrees will be given.

The buildings of an American University have very varying architectural value. As a rule, with the exceptions which have been noted above, they are confined to one area which is called a "campus," except at Harvard, where it is known as the "Yard." A Harvard man is quite as irritated by a stranger calling his "yard" a "campus" as a Cambridge man is when anyone applies the Oxford term "quad" to his College "courts."

**Picturesque Architecture.**

The older Universities, such as Yale and Harvard, have a certain kind of antiquity, and some of their buildings have worn a little shabby. On the other hand their newer buildings are often charming and suitable. Most of the Universities are in great commercial cities; but Princeton is in a delightful village by itself, five miles from the main line and, as the University has bought up all the land between their Campus and the Pennsylvanian Railway, it is likely to remain in comparative peace. The North-Western University is likewise in the charming township of Evaston on the shores of a Lake.

The University of Chicago, the George Washington University at St. Louis, the Rice Institute at Texas,

have all been built at one time and by one architect, or firm of architects, and they have a unity in design and in proportion. The Roman Catholic Universities are particularly happy in their choice of sites and in the beauty of their buildings. Those of their belief have an abiding faith, and will wait thirty or forty years until they can acquire the site they desire, and will then draw up the plans for a great University, although they have only the money to build one of many buildings.

As a rule the interior of the buildings of the American Universities are spacious. The staircases and passages are wide, lifts abound, and the drinking water bubbles up at frequent fountains. The dryness of the atmosphere in the rooms, which to Europeans seem to be terribly overheated, makes this provision necessary.

Many of the better buildings are copies from Cambridge or from Oxford, and some of the interiors are decorated with really beautiful frescoes or hung with fine pictures, and some of the stained glass windows are in comparison as good as any modern windows in the Old World.

The Universities are with hardly an exception recruited from the so-called High Schools. As a rule children attend the town schools for six or seven years —until they are fourteen or fifteen. But the public secondary schools, or high schools, continue the education of those who desire it for another four years, and it is from this source that the Universities draw most of their students. Many are admitted on attaining a certain number of credits during the preceding three or four years. A few others pass a special entrance examination.

Most of the Universities have an insurance scheme against sickness. At Michigan, for instance, every student, male or female, pays five dollars a year, and for this sum he obtains free medical advice, free nursing and housing in a nursing home, and special diet for a period of three weeks. Severe and lengthy cases involve a small extra payment. In this University five fully qualified medical men give their full time in attending to the health and hygiene of the undergraduates, both men and women.

In the University of Pennsylvania no one is allowed to take part in sports until he has been inspected by the Professor of Physical Culture and a doctor or two, and it is quite surprising at the beginning of the October term to find a very large proportion of men who are slightly defective either in sight or hearing, trouble with their teeth or with their tonsils, and some other minor defect. These are all promptly dealt with by specialists.

Physical culture is much more developed in the United States than with us, and in many of the State Universities army training is enforced, and army uniform is worn during the first two years of the undergraduate life.

In American Universities many things are taught which we do not associate with a University career here. Schools of Journalism abound, but seem to produce little effect on the standard of the newspapers. Accountancy is taught, commercial law, stenography, typewriting, and students in these subjects have to read a little history and very little French ; but somehow or other it does not seem to arouse a very intimate literary feeling ; for a very capable young student typist I once employed in Philadelphia was simply bored to death by having to read Kipling and "Treasure Island," a course which had been laid down for him in order to widen his mind.

Credits may be obtained in some Universities in elementary millinery and hotel management. One lady proposed to study the following subjects in her final year for the B.Sc. :—Shakespeare, Invalid Cookery, Advanced Organic Chemistry, Natural Dancing, Pottery, Jewellery, and Greek History. It is only fair to add that such a programme is comparatively rare.

### University Government.

The government of an American University is vested largely in the President. This is the general title of the head of each seat of learning, though there is a Chancellor at the George Washington University at St. Louis and a Provost at the University of Pennsylvania. Above the President stands the Trustees or Regents, or at Harvard the Overseers—generally men of high standing in the commercial world, and it is these Trustees who exert themselves so actively in obtaining the magnificent endowments for which America is so remarkable. In the State Universities some of the Trustees are elected by the Legislature, and it is a remarkable and regrettable feature that as a rule the Faculty, *i.e.*, the Professors, have no seat on the Governing Body of these Universities. The only link between them and the Trustees is the President. Sometimes a multi-millionaire is able to control the policy of the newer colleges by withholding or increasing his benefactions, and this does not work well. The President is very much of an autocrat ; he can make or unmake careers and takes a large part in the appointment and dismissal of Professors. Each Faculty is headed by a Dean, not necessarily the senior member.

The staff is insufficiently paid. Throughout the

world education is one of the worse paid of all human professions. "The cheapest thing a-going to-day," says the satirist, "is education." "I pay my cook," Crates said ironically, "£4 a year; but a philosopher can be hired for about sixpence and tutor for about 1½d." "So to-day," writes Erasmus, "a man stands aghast at the thought of paying for his boy's education a sum which would buy a foal or hire a servant. Frugality! It is another name for madness." This madness has not abated during the last four hundred years.

### Psychological Tests.

American institutions are always ready to try some new thing, and during the war Columbia University had been so impressed by the psychological tests used for entry into the American Air Force, that it proposed to give up its entrance examination and to replace it by mechanical tests which it thought would be able to show whether a boy was capable of profiting by a University education. One does not quite know how far it succeeded, but the American youth is so alert and quick that he frequently reacts to the stimulus before it is applied. Historical first-year students in the same University at that time began to start their history lectures with Bolshevism and gradually work backwards, but they did get very far back.

As a rule the average entrance age is about the same as in Great Britain, but a student takes four years over his B.A. degree and about three more for the M.A. He is expected to obtain at his High School a certain number of units, each of which corresponds with a quarter of a year's study in any subject at one of these schools, so that four years spent there should produce sixteen units. Universities which admit on less than fourteen units are not regarded as in the first class. Some of the Universities and Colleges in the Eastern States have co-ordinated their entrance qualifications under a College Entrance Examination Board, something like that which exists for the Northern Universities in England. The standard is fairly high. In the West and Middle West some institutions admit freshmen on a certificate from their Head Master. All the entrance gates to the Universities are widened for foreigners who are welcome if they can show that they would really benefit by studying at any given College.

The Universities have very magnificent clubs, some of them with libraries whose books are all fully bound in morocco. Here, whence I first went to America forty years ago, the more fashionable students had their meals, whilst the less gilded youths dined at boarding-houses. But nowadays large refectories have replaced these feeding arrangements. Attendance at chapel varies, but has practically ceased to be compulsory. Yale was perhaps the last University to hold out, but recently that has joined the majority.

There are two criticisms we can make of the American University system in general. One is the number of options each of which may be taken in the first, the second, or the third year. Hence the level of the questions has to be kept down to a freshman's capacity. There is no progressive difficulty in the successive annual examinations as there is with us. The second criticism is that there are practically no external examiners. The examinations are held only by the Professors. Hence the students get up their Professor's lectures rather than the subject, and these can generally be bought for a dollar or two typewritten at the book-store.

The general absence of Honours Courses in American Universities tends to depress the standard of a degree to a common level, and perhaps not a very high one. At the same time men who want to read more deeply than the ordinary courses of lectures demand, receive every facility and help. America at the present time is producing an ever-increasing number of researchers; this is especially true of History and some of the Physical Sciences. There are those who assert that the average degree at Harvard is as high a standard as that reached at Oxford or Cambridge. Certainly the insistence on attendance at lectures is more strict in America than it is with us, but I doubt if they do produce quite the high level as such men who are top of the Classical, Mathematical, and Natural Sciences final examinations in the old Universities of England.

The fact that many students earn their way through College has been referred to in the first series of articles. It was brought home to Sir Michael Foster who, returning from a lecture trip in California and dining at Seattle, was rather surprised when half-way through the meal the youth who was waiting on him suddenly seized his hand and said, "Professor, I am very glad to make your acquaintance. Many and many weary hours have I spent over that textbook of yours." At the present time there is an increasing set of Westerners studying the United States. Three or four years ago 5,000 foreign students were there. One cannot help feeling that the verse of Miss Mary Coleridge is becoming truer in a wider and larger sense:—

> "We were young, we were merry, we were very, very wise
> And the door stood open at our feast,
> When there passed by a woman with the West in her eyes,
> And a man with his back to the East."

# Ants as a Factor in Human Life.

**By F. Balfour Browne, M.A., F.R.S.E., F.Z.S., F.E.S.,**

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*While the social organization of ants is a source of much interest, it is not generally known to how great an extent the activities of these insects affect human life. Particularly in tropical countries, they present many problems to agriculturists; and a really effective method of destroying domestic ants has yet to be discovered.*

WALLACE, in his "Travels on the Amazon," states that, in the tropics, lizards are the first creatures that attract one's notice by reason of their abundance and, after them, the ants.

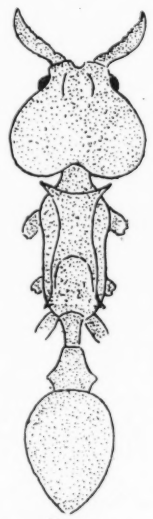

FIG. 1.
TRUE ANT
for comparison with Fig. 2.

From the earliest times these little insects have been regarded as typifying hard work and, as everyone enjoys watching other people, or things, working, and as ants are easily observed, a considerable amount is known as to their habits, which are among the most interesting in insects. A large proportion of their activities seem to be useless, and Mark Twain gives a very humorous account of them in "A Tramp Abroad."

The interest is partly based upon the fact that all ants are social insects—that is, the members of the family live together and work for the common good. And this ant civilization must be very ancient since in all other social insects we find some evidence of the method of evolution of social life. For instance, in the bees and wasps, which are relations of the ants, we have both solitary and social forms and, especially in the wasps, we find forms which are intermediate stages between the two. In the termites, or so-called "white ants," which are not related to the true ants (Figs. 1 and 2), we find all stages from very simple societies consisting of a few individuals to the highly-evolved ones consisting of thousands; and Wheeler, in his charming book on "Social Life among the Insects," describes the termites as "primitive social cockroaches" (p. 244).

Ants, however, give us no clue as to their solitary ancestors, and they have evolved their civilization to such an extent that among them are forms which, like many human beings in our higher civilizations, depend upon others for their well-being and for that of their offspring. However, it is not my purpose here to enter upon the habits of ants as such, but to consider certain habits which affect the well-being of the human race, because in certain ways these very abundant insects are useful, whereas in others they are directly or indirectly injurious.

In certain parts of the world several different groups of ants have developed into what are known as "honey ants." All over the world ants are fond of the nectar of flowers and other sweet juices and this nectar is, in many cases, converted into honey in the ant's crop. Among most societies of ants the workers, on returning to the nest, feed other individuals from the contents of the crop. Among honey ants certain individuals in the nest act as honey reservoirs, receiving honey from the returning foragers and distributing it as required amongst other individuals and, in certain kinds, this habit has developed to such an extent that the abdomens of these reservoir individuals swell up to many times their normal size, so that these ants become quite incapable of walking. When so gorged, they are lifted by other workers—strung up, as it were, to the rafters of the nest, like flitches of bacon, to be taken down when required and replaced after use.

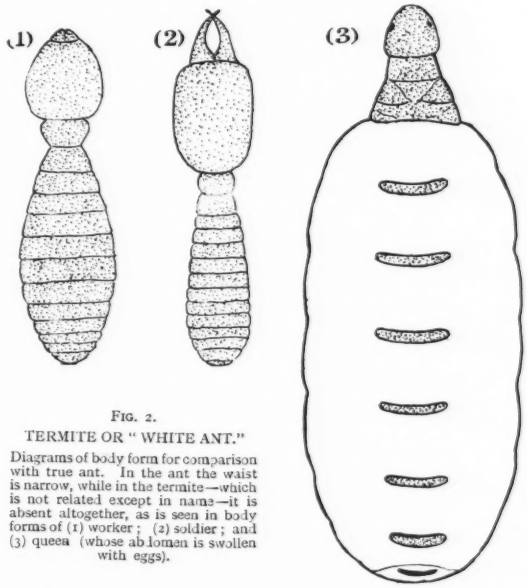


FIG. 2.
TERMITE OR "WHITE ANT."
Diagrams of body form for comparison with true ant. In the ant the waist is narrow, while in the termite—which is not related except in name—it is absent altogether, as is seen in body forms of (1) worker; (2) soldier; and (3) queen (whose abdomen is swollen with eggs).

These individuals themselves provide the means of fixing to the roof as they hold on by means of their jaws. (Figs. 3 and 4).

Man has taken advantage of this habit among ants—which is apparently associated with a climate where there is a long period of drought, when food and liquid refreshment are difficult to obtain—and he raids the nests and devours the reservoir individuals, or their abdomens—(after all, some people eat the whole shrimp while others are more particular)—and these honey ants are sold by the pound in many markets—for instance, in Mexico. Wallace mentions, in the book already referred to, that certain large ants and also so-called "white ants" are occasional luxuries among the Indians on the Rio Negro, and we may therefore regard ants as useful, to a limited extent, as an article of human food.

Most ants are scavengers and are therefore useful in breaking down dead organic material, since the simplified products become more quickly available once more for plant life; and by zoologists, this scavenger habit is sometimes taken advantage of in obtaining perfect skeletons of small animals. Under ordinary circumstances such skeletons are obtained by long boiling and hand cleaning, or by slow decay of the soft parts in cold water but, if an ants' nest is handy, it is only necessary to place the carcase upon it to ensure a perfect skeleton in a very short time.

### Ants and Agriculture.

Many ants form their nests in the soil or on the surface, and such ants are useful in various ways. For instance, those which form nests upon the ground may be gathering together dead vegetable material which has fallen broadcast from the trees, and the heaping up of such material will tend to hasten its decay and conversion into vegetable mould. Those ants which burrow bring up the subsoil, and thus help to mix mineral and vegetable soils and make a compost suitable for plant life. Those ants which nest beneath stones are helping, by removing the soil beneath the stones, to lower these into the ground, a very important work also carried on by earthworms, as referred to at length by Darwin in the fascinating book upon "Vegetable Mould and Earthworms." Certain ants, moreover, carry down vast quantities of leaf tissue, cut from the living trees and, at depths of even five or six feet, construct what have been called "fungus gardens," the fungus upon which they feed being cultivated by them on the decaying leaves brought by them to the garden. These "leaf-cutter, or parasol ants" are familiar objects in many parts of the tropics, where long processions of what appear to be animated pieces of green leaves may be seen on the forest paths.

All these ants are of use in that they are cultivating the soil and tending to keep it fit for vegetation, which is in so many ways essential to the welfare of man.

Occasionally ants are made use of by man in a rather curious way. For instance, in Java there is a small bug (Helopeltis) which does much damage by sucking the sap of the cacao trees. It was noticed that where the black cacao ant was present less damage was done by the bug, apparently only because the frequent passage of the ants disturbs the bugs and interferes with their feeding. The ant forms nests in the trees, and the planters, besides protecting these, place artificial nests among the branches to encourage the ants.

### Ants as Pests.

Just as man has domesticated and made use of various animals, so have the ants domesticated and made use of various insects. Two groups in particular, the aphides or plant lice and the coccids or scale insects, provide domestic animals for ants, and to this end the insects are protected, sometimes by having shelters built over them and sometimes by being carried to the nest, and in some cases they are wintered in the ants' nest and carried out to their food plants in the spring. Unfortunately, plant lice and scale insects suck the sap of plants and do immense damage to our trees and crops, and we are waging perpetual war against them, so that since ants frequently protect the very species we are attempting to destroy, they are indirectly but seriously injurious to mankind. In different parts of the world ants have thus ruined various industries. For instance, in Madeira, coffee growing was ruined many years ago owing to the activities of a small ant which protected and encouraged a small coffee scale insect. About twenty-five years ago a South American species, the "Argentine Ant," arrived in Madeira and extended the damage done by the earlier species. This insect, according to Dr. Grabham, who gave a paper upon it at the Bournemouth Meeting of the British Association in 1919, has carried on a scale insect fostering industry on most of the fruiting trees in the island, and has ruined whole districts of sweet potato through introducing and protecting a scale insect upon this plant. An excellent article upon this species appeared in May, 1925, in this journal.*

Cultivated ground is attractive to many species of ants, and in their subterranean operations they may

* "The Argentine Ant." By S. S. Light and F. G. S. Whitfield. *Discovery*, vol. VI, p. 171.

do considerable damage to the roots of choice plants. Not infrequently specimens in the herbaceous border or the rockery suddenly wilt and die, and examination often shows damage to the root-system and the presence of ants' galleries in the soil. Lawns, in this country and elsewhere, are frequently damaged by upheavals of fine soil from the working of a small yellow or black ant; in fact, in many ways the ant is to be regarded as anything but the gardener's friend.

Not only do ants invade our gardens but some kinds, especially one or two introduced foreigners from warmer climes, invade our houses. In various parts of the tropics, apart from what might be called domesticated species, houses are temporarily invaded by huge hordes of "legionary" or "wandering" ants, which pass through or over any obstruction they meet during their marches. These curious ants make no nest, but merely camp at nights in a hollow tree or under some shelter where they form a vast mass of thousands of individuals, which assemble together so as to provide galleries to the interior of the mass where the queen, eggs, and brood are taken for shelter. Belt, in "The Naturalist in Nicaragua," gives a most interesting account of their habits, and Savage, in 1847, gave a detailed account of an invasion by one of these armies. The first sign of the approach to a house is recognized by the simultaneous and universal movement of rats, mice, lizards, insects, and other vermin, and once the army enters the house, the human inhabitants also vacate it, returning a few days later to find everything in order excepting certain food materials which have been devoured by the invaders.

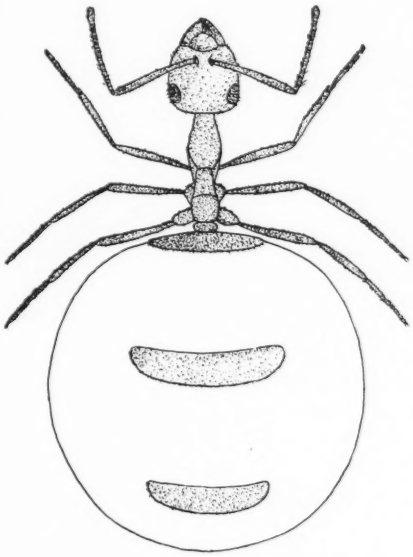

FIG. 3.
HONEY ANT WITH SWOLLEN ABDOMEN.
Some honey ants act as foragers for the community, others are used as honey reservoirs and are hung up in the roof of the nest until required. These are sold as food by the pound in many markets, *e.g.*, in Mexico.

**Methods for Destroying Ants.**

It is quite clear in such a case where the ants are large and fierce, and in countless numbers, that discretion is the better part of valour, especially since it is impossible to attack these ants in what is normally the ant's vulnerable point, the nest. Here there is no nest, and the armies seldom remain long in one place. With other species, however, methods have been devised for controlling their activities, and although these are few and only successful to a limited extent, they are the best known up to the present time.

In the first place, the destruction of the nest is an obvious remedy where the nest is within reach. In the case of those species which nest among the leaves of trees, as many do in warmer countries, destruction is easy. Nests in hollow trees and branches may or may not be easy to reach, but where the nest can be removed as a whole or in pieces, and placed upon a fire or sprayed with paraffin and lighted or, if small enough, dropped into a bucket of paraffin where fire cannot be used, destruction is rapid and certain. As, however, some nests of tropical species would fill a cart, removal is not easy, and firing *in situ* seems to be the only remedy, and is often not possible because of the danger of a general conflagration.

Where the nest is subterranean it is often possible to use a poison gas to destroy the occupants and, as in many tropical species, the galleries may extent five or six feet beneath the surface, a special machine is on the market for pumping poisonous fumes into them. Smaller nests, such as those in this country, can be gassed more simply by driving down into them a bluntly-pointed stick, or better, a long tube, and pouring into the hole or down the tube one or two ounces of carbon disulphide. If the nest is a large one, several such holes may be made in it, and as a rule

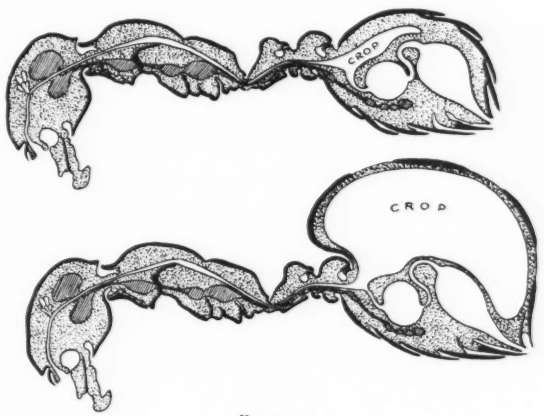


FIG. 4.
DIAGRAMMATIC SECTIONS OF STARVED AND REPLETE HONEY ANTS.
Honey ants convert the nectar of flowers into honey in their crops, which become immensely swollen, as shown by the above diagrammatic median sections of starved and replete specimens.

it is easy to tell when the hole is deep enough because the stick or tube comes against the hard soil beneath the nest. This method is only effective if applied in dry and warm weather, as under these conditions the liquid more readily evaporates and the deadly gas circulates freely in the galleries. Where the nest is in a wall, wads of cotton-wool saturated with carbon disulphide and pushed into any recognized entrances in the evening when the family has retired to rest will be effective.

**Destruction by Poison.**

If it is not possible to attack the nest, the only chance of destroying it seems to be by supplying the foragers with poisoned food, and this is difficult and to some extent dangerous. It is necessary to place the poisoned material in positions where the ants will readily find it and, since the poisons used are usually also poisons to human beings and domestic animals, great care is necessary in the way they are exposed.

Arsenic and phosphorus are two useful substances and are best supplied to the ants mixed with honey or sugar syrup. With regard to method of using, arsenic and sugar solution or honey, or phosphorus and honey, can be put into jampots or tins with lids which fit badly. The lid limits evaporation and protects the contents from the tongues of dogs and cats and, if a trail of honey leads to the receptacle, the ants will find their way in by the small openings under the lid. It is well to label such jars and to place them out of reach of children.

In California a syrup is used in the orchards to destroy the "Argentine Ant" already mentioned. The actual formula is as follows:—10 pints of hot water; 7 grams crystallized tartaric acid; 9 grams benzoate of soda; 12 lb. granulated sugar and 2 lb. strained honey. Allow to boil slowly for 35 minutes and then add a solution of sodium arsenite—$\frac{3}{4}$ oz. in 1 pint of hot water. This produces about $2\frac{1}{2}$ gallons of syrup but, of course, a smaller quantity can be made.

Although this syrup has been used effectively in California, it is interesting to note that Forel ("Senses of Insects," p. 103), states that hundreds of individuals of one species of ant with which he worked crammed themselves with honey full of arsensious acid without a single one of them appearing to suffer. In spite of this, however, I think arsenic and honey will be found efficient as a destroyer of household ants. But these poisons are unpleasant things to have in houses, and it might be found that some of the cockroach killers, such as powdered borax and chocolate or plaster of paris and sugar, as mentioned by Mr. Laing in the British Museum pamphlet on the cockroach, would be effective.

Various materials are useful for keeping ants away from limited areas. For instance, sawdust soaked in paraffin and scattered over the haunts of ants will cause their disappearance from that particular spot. A mixture of alum and charcoal is equally effective and less unpleasant to deal with.

Powdered cloves placed round a dish will keep ants out of the dish, and Dr. Grabham, in the paper already referred to, mentions that powdered chalk has a mysterious action upon ants. They attempt to pass over it, feel it excitedly with their antennae and then leap away to the ground. This was where chalk was scattered over fruit trees, and it is said that after a few hours not an ant can be found on a tree so treated. Chalk might therefore be useful instead of powdered cloves on the larder shelves, and it would be much cheaper.

But deterrents are unsatisfactory because they have to be renewed frequently, and we are still wanting a really satisfactory domestic ant destroyer.

## A New Microscope Lamp.

A NEW type of microscope lamp is described among other optical apparatus in a booklet recently issued by Messrs. Ogilvy & Co., of 20 Mortimer Street, London. The lamp is of the sub-stage form, and has been produced by Dr. H. Hartridge of Cambridge and Mr. C. F. Williams of London. The outstanding feature of this lamp is that it is an *axial* illuminator. The importance of fixing the far end of the optic axis cannot be over-estimated. Every worker is familiar when changing an objective with the present tiresome and unscientific method of moving the slide, shifting the mirror, and "re-centering" the condenser. To the axial illuminator belongs the important function of rigidly maintaining the carefully determined axis. As it is now increasingly evident that the microscope is developing along the lines of the optical bench, it becomes apparent that the optic axis, which is determined by the centres of the eye-piece and an accurately fitted objective, must continue throughout the entire instrument and end in a central and circular source of light. In contrast to the old paraffin "flame edge" placed end on, giving a vertical streak of light which unevenly lit the apertures of condenser and objective, this controllable area of light, by equally lighting all aximuths of the condenser, provides the proper condition for the fullest efficient resolving power of the objective. This iris-controlled area may be contracted to within the visible limits of the field of view, thus minimizing glare and flooding with the higher apertures.

# Correspondence.

## "LIVY AS A POLITICIAN."

*To the Editor of* DISCOVERY.

SIR,

In the November number of *Discovery* Prof. Conway has summarized some chapters from the fortieth book of Livy, which culminate in the speeches delivered in their father's presence by Perseus and Demetrius, the sons of King Philip of Macedon, the former accusing his brother of having planned his assassination, whilst the latter refutes the charge. Prof. Conway draws attention to the length of these speeches for which, he says, there is no parallel in Livy, and goes on to say: "Now everyone knows that the difference in length is not due to any similar difference in the records which he had before him, for no such records existed." Then, seeking an explanation, he describes the well-known difficulties encountered by Augustus in his attempt to found a dynasty and, in particular, an intrigue of somewhere about A.D. 7 which revolved about the question of the succession. "Is it possible," he concludes, "to doubt that the plot of Perseus against his young half-brother Demetrius must have seemed to Livy to present a lively analogue to miseries which he knew nearer home?"

I must confess that I should have thought that if the analogy did strike Livy at all, a writer so notoriously discreet would have been more likely to pass hastily over the "hidden ashes" than to linger over them. That, of course, is a matter of opinion. There can surely be no question that there is a serious flaw in Prof. Conway's premisses. So far from Livy having no records before him, it is practically certain that the speeches were in Polybius.

It is true that the Greek historian's account of the episode is almost entirely lost to us. Two fragments, however, are left, and one of these bears directly on our question.

The culminating scene in Livy may be divided into three parts—the introductory speech of Philip, the accusation by Perseus, the defence by Demetrius. The fragment of Polybius belongs to the first section.

In Livy the King points out that he has been expecting this explosion, though he had hoped that the young men would some day remember that they were brothers, remember the days when they were boys together, remember

"the lessons I taught you, but which I fear I dinned into deaf ears. How often did I express to you my horror at instances of brothers' feuds, recounting the dreadful results which such men produced, results that involved the destruction of themselves, their family, their homes, and their kingdoms. And then I would set on the other side instances of the better kind, such as the sharing of power as though by deed of partnership between the Kings of Sparta, which for many ages was the saving of themselves and their country; yet as soon as the habit of trying to monopolize tyrannical power for oneself had come in, that same Sparta perished. Again (I would say), the brothers Eumenes and Attalus of our own day, starting with power so small that their title was a slight to the word 'King,' have by no other means than brotherly concord raised their realm to the level of my own, of that of Antiochus, of that of any present-day King."

And now for the fragment of Polybius (XXIII ii, Büttner-Wobst IV, p. 142):—

One must not only read tragedies, legends, and histories, but must understand and study them. In all of them one can see that brothers who have come to be at feud and enmity with each other, and have let this state of things go far, have without exception not only destroyed themselves but have ruined their substance, children, and cities. But such as have striven to moderate self-love and to bear one another's errors, these have kept all those things that I enumerated and all their lives enjoyed the fairest of reputations. Again, I often made you observe the Kings of Sparta, how they kept for their country the hegemony of Greece so long as they obeyed the ephors and were content to share the throne. But when they quarrelled and changed their rule to monarchy, they made Sparta experience all kinds of evil. And, finally, I was for ever mentioning as a warning and putting before your eyes the Eumenes and Altalus of our own times, showing how they succeeded to a realm that was small and commonplace, yet have raised it to a position inferior to none by no other means than goodwill and concord and the gift of mutual esteem. But you so far from taking it to heart did, as it seems to me, but make fiercer your resentment against each other."

The form in which this fragment is preserved leaves us entirely in ignorance as to who is the speaker. It cannot, however, be doubted that these are part of the words put in the mouth of Philip by Polybius in his account of our episode. Livy has done little more than give a free version of it (adding no doubt the Roman *exempla* of the Quinctii and Scipio brothers). It is to my mind almost certain that if we had the rest of the story in Polybius we should find that Livy has simply adopted the same course with regard to the speeches of Perseus and Demetrius, which must, of course, have been given by Polybius.

If there were really any reason to suppose that Livy had materially enlarged the record of Polybius, I should be more inclined to ascribe such a procedure to the influence upon him of the declamation-school, in which a pair of hostile brothers was a regular theme, than to a motive which seems to me to reflect so little credit upon his commonsense and tact as a friend of Augustus. But allusion-hunting and influence-tracing are dangerous pursuits, and I much prefer my other explanation—that Polybius had himself put long speeches in the mouths of the princes.

Yours, etc.,

University of Sheffield. WALTER C. SUMMERS.

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## THE AUTHOR'S REPLY.

Professor Conway writes:—

I am very glad that my distinguished friend Professor Walter Summers has brought his own study of Livy to bear on one of the points raised by my article in the November number. By an interesting observation, he has corrected a misconception which may, I am afraid, have arisen from the brevity of my reference to the Greek historian Polybius—of whom I only said (summarizing two or three pages) that he had compared the story to a Greek tragedy. Professor Summers has enabled readers of *Discovery* to compare for themselves a part of the speech attributed to Philip by Livy in the trial scene (XL, 8), with a fragment of Polybius which seems to be the whole or part of Polybius' account of what Philip said. No one who makes the comparison can doubt that this part of Polybius' history was before Livy when he composed that orations Professor Summers is clearly right in thinking that two allusion. which appear in Livy and in Polybius, the first to the Kings of Sparta and the second to Eumenes and Attalus, cannot possibly have appeared in Livy merely by accident when they had been included before in Polybius' description of the same scene.

But Professor Summers draws the inference, I gather, that this same pair of allusions had actually been used by Philip himself; and that the record given us by Polybius is historical in the full modern sense of the word. He concludes therefore that this completely disproves the statement which he quotes from my article:—"Everyone knows that the difference in length (of the speeches inserted by Livy at different points) is not due to any similar difference in the records which Livy had before him, for no such records existed."

Let me admit at once that had the latter part of this fragment of Polybius been freshly in my mind, I should have worded my sentence so as to preclude the interpretation which Professor Summers has naturally placed upon it, thinking that I meant to say that there was no record whatever of what Philip or his sons had said. In fact, this was not what I meant, as indeed a moment's reflection will show. It was far from my mind to attribute to Livy the invention of the whole scene, or even of the general drift of what was said by each of the speakers. Of course, some of those who were present must have retained some recollection of the scene which by one channel or another reached Polybius; and of course, also Livy made full use of Polybius' narrative as he regularly does. By "such records" I meant such as embodied fully and precisely what was said at the time, such in fact as a reader who knew nothing of the customs of ancient historians would suppose that Livy had transcribed. In this sense I wrote, and I still maintain, that no such records had survived. And I can now call to witness Professor Summers himself; for even he admits that immediately after the small passage which he translates, Livy introduced examples from Roman history which do not appear in the passage from Polybius. It is clear also that they were never part of his account, since after the examples from Greek history, the speech in Polybius, if speech it can be called, lapses again into the commonplace moralizing that makes the speeches which Polybius puts into his narrative both unreadable and unreal. This very fragment of Polybius contains twenty-eight lines. Livy has put the whole substance of it into thirteen; and in Livy's version every sentence carries its point home. Yet Livy is not content with having made this selection from Polybius' material; he begins and ends with sentences of arresting power. Consider some parts of it from Philemon Holland's translation, the force of which every reader can feel, though it falls far short of the massive periods alternating with thunderous short sentences of warning which Livy's imagination has conceived.

"Here sit I, a most wretched father, to be a judge between my two sons, the one plaintiff, the other defendant in a charge of attempted murder; and to find, on my own house and blood, the stain of that crime, either falsely alleged or in deed essayed. . . During my natural life, while breath is still in my body, both of you, seduced by inordinate desire, are ready to take possession of my kingdom over my head. And so long only would you have me to live, until by surviving the one of you, I might then, by my death, leave the other my sole heir. Sick ye are, I see well, of father and brother; ye can abide neither the one nor the other. . . . An unsatiable desire to be King hath possessed your hearts. Come on therefore now, if you must, and grieve and wound your father's ears with your reciprocal accusations, you that full soon, I know, will be for deciding it by dint of sword. Spare not; speak out all that either you can allege truly, or list to invent falsely. Mine ears are now open; but hereafter they shall be close shut against all secret slanders that you may report one against the other."

Professor Summers no doubt will reply that Livy loved declamation, as indeed I pointed out in the longer article on which that in *Discovery* was based. But the question remains why Livy chose to expand this particular scene with so much feeling. Professor Summers would have us believe that it was merely because Polybius had written long speeches for this passage and that Livy therefore reproduced them without more ado. How far it is true to say that Livy reproduced Polybius the reader can judge, if he will compare the extract just given with the passage from Polybius which Professor Summers translates.

On the general question of Livy's relations to Polybius I must here be content to refer to another lecture (published in the *Bulletin of the John Rylands Library*), entitled "The Portrait of a Roman Nobleman in Livy," where I have analysed at some length the differences between the accounts given by Polybius and Livy of the character of Scipio, and in particular of Scipio's speeches. No one who realizes how freely Livy reshaped his material in the fire of his own imaginative insight will be inclined to attach much importance to the length of any particular part of Polybius' narrative. Here, therefore, I am afraid Professor Summers and I must agree to differ; and I should differ also from his description of Livy as "discreet"—if by that he means, as his wording suggests, that Livy was culpably timid in expressing his convictions. If he had been, he would not have praised Brutus and Cassius, and Augustus would not have complained of the Pompeian sympathies which he found in Livy's later Books; nor would Livy, in his own preface, have described his own generation as being "unable to bear the remedies" it needed, those, namely, provided by the imperial system.

So much I felt bound to say in humble demur to Professor Summers' seeming disparagement of one of the noblest minds that ever wrote history. But in truth the objection is wholly irrelevant. My contention was, and is, that the passage was written by Livy before the execution of Agrippa by Tiberius, and possibly even before his banishment through the influence of Tiberius and his mother Livia. To the aged Augustus himself, whose visit to Planasia in A.D. 13 shows how he yearned to pardon his grandson, probably nothing could have been more welcome than a plea for mercy and conciliation rather than severity in such a case. But when Tiberius came to the throne, we find Livy in old age deserting Rome and going to spend his last years in the little country town of Patavium.

The judgment of any one scholar on such matters is no doubt quite fallible; but such as mine is, it has been formed after spending more than a quarter of a century in intimate study of what Livy wrote. And the reader may perhaps be interested to see a few comments on the article in *Discovery* that have reached me, written (on 17th November) by Professor Werner Jaeger of Berlin, whose reconstruction of the life and personality of Aristotle from his writings is everywhere regarded as one of the greatest achievements of scholarship.

"This psychological interpretation of Livy's presentment of the tragedy of Philip V and his sons must be right. That is the best explanation of the feeling which the historian evinces (*die innere Anteilnahme*) in the subject of his narrative; for in the history of earlier times men always apprehend most vividly things that they have experienced in their own life. The intensity of feeling with which Livy draws his picture is not to be explained as merely rhetorical pathos."

This last sentence, it will be seen, expresses an opinion diametrically opposite to that with which Professor Summers is content.

## THE CANADIAN MUSK PLANT.

*To the Editor of* DISCOVERY.

SIR,

Mr. Neave's letter in the Christmas number of *Discovery* prompts me to suggest that there is one subject at least upon which others beside myself would be glad of information from British Columbia. That country is the home of the musk plant (*Mimulus moschata*), which some thirty years ago began to lose its scent in gardens, until it completely disappeared from all plants in cultivation, and a careful search carried out recently by many people failed to produce a single plant with the old-remembered scent.

According to the accounts of the early botanical explorers, scented strains were to be met only here and there among the

wild plants, yet it would be strange if these had now disappeared altogether.

Mr. Neave would be doing a good service to gardeners if he could find out whether any of the wild plants in British Columbia are scented and, if so, whether the presence of scent is associated with any factors in the soil or the surroundings or with any botanical characters.

The finding of a scented strain would be a discovery well worth reporting, and the re-introduction of it into Europe would be very much appreciated.

I am, etc.,

59 Queen Anne Street, F. A. HAMPTON.
London, W.1.

## AMAZON VALLEY PROBLEMS.

*To the Editor of* DISCOVERY.

SIR,

My attention has been called to the article by C. W. Domville-Fife in the November number of your magazine, in which reference is made to stories of white Indians and to the parti-coloured skin found among the Pammary Indians. From the photograph reproduced there can be little doubt that this member of the Pammary tribe is suffering from a disease commonly called Pinta—a fungus disease met with in Mexico, Central America, Venezuela, Columbia, Bolivia, and in parts of Peru, Chili, Guatemala, Honduras, and Brazil.

The fungus grows in the skin and may produce areas of varying colour—white, red, blue, or black. White often predominates, and the whole skin may thus be depigmented. It is a contagious disease, so that in some districts nearly the whole population may be affected.

"White Indians" may therefore be cases of Pinta where the whole skin (and hair) has become affected or they may be cases of complete albinism—a condition not so very rare among all coloured races. The fair-skinned natives rather than the white-skinned examples would be cases of rufism, also well-known among dark-skinned races. Certainly the condition is not caused by a dye or by drinking the juices of certain poisonous herbs.

I am, Yours faithfully,

HUGH S. STANNUS,
57 Russell Square, W.C.1. (M.D., M.R.C.P., F.R.A.I.)

# Books Received

*Man not a Machine.* By EUGENIO RIGNANO
*Fee, Fi, Fo, Fum.* By H. J. MASSINGHAM.
*Myths in Primitive Psychology.* By B. MALINOWSKI. (Kegan Paul, Trench, Trubner & Co. Ltd. Each 2*s.* 6*d.*).
*Volume Alterations on and in Solution.* By FRANK L. TEED. (H. K. Lewis & Co. Ltd. 3*s.* 6*d.*).
*Projective Geometry.* By CLEMENT V. DUSELL, M.A. (Macmillan & Co. Ltd. 7*s.* 6*d.*).
*An Outline of Plant Geography.* By DOUGLAS HOUGHTON CAMPBELL. (Macmillan & Co. Ltd. 17*s.*).
*Supplement to an Introduction to Sedimentary Petrography.* By HENRY B. MILNER, M.A., F.G.S., M.Inst.P.T. (Thomas Murby & Co. 9*s.* 6*d.*).
*The Dial Machine.* By T. C. J. ELLIOTT. (The Peterborough Press Ltd. 4*s.* 6*d.*).
*The Reproduction of Life.* By A. J. COKKNIS. (Baillière, Tindall & Cox. 10*s.* 6*d.*).
*Island Universes.* By W. J. LUYTEN. (Harvard Observatory Reprint 32.)
*The Hunter in our Midst.* By R. LOWE THOMPSON. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s.* 6*d.*).
*Types of Mind and Body.* By E. MILLER. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s.* 6*d.*).
*Lucullus, the Food of the Future.* By OLGA HARTLEY and MRS. C. F. LEYEL. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s.* 6*d.*).
*Field Astronomy for Engineers and Surveyors.* By DAVID CLARK, M.A., B.Sc., etc. (Constable & Co. Ltd. 10*s.* 6*d.*).
*Three Lectures on Atomic Physics.* By ARNOLD SOMMERFELD. Translated by HENRY L. BROSE, M.A., D.Phil. (Methuen & Co. Ltd. 2*s.* 6*d.*).
*An Introduction to Physical Chemistry.* By F. B. FINTER, M.A. (Longmans, Green & Co. Ltd. 6*s.*).
*Psychology Applied to Education.* By the late JAMES WARD. (Cambridge University Press. 10*s.* 6*d.*).
*The Largest Ships of the World.* By V. S. FELLOWES WILSON, F.R.G.S. (Crosby Lockwood & Son. 10*s.* 6*d.*).
*Picture Postcards.* Sets C 17, C 18. (British Museum: Natural History. 1*s.* a set).
*After-Dinner Philosophy.* By C. E. M. JOAD and JOHN STRACHEY. Preface by J. C. STOBART. (George Routledge & Sons Ltd. 3*s.* 6*d.*).
*Reptiles and Amphibians.* By THOMAS BARBOUR. (George G. Harrap & Co. Ltd. 10*s.* 6*d.*).
*A View of Sierra Leone.* By F. W. H. MIGEOD, F.R.G.S., F.R.A.I. (Kegan Paul, Trench, Trubner & Co. Ltd. 31*s.* 6*d.*).
*Practical Physics.* By T. G. BEDFORD, M.A., F.Inst.P. (Longmans, Green & Co. Ltd. 10*s.* 6*d.*).
*Rain-Making and other Weather Vagaries.* By W. J. HUMPHREYS. (Baillière, Tindall & Cox. 11*s.* 6*d.*).
*Beyond the Milky Way.* By GEORGE ELLERY HALE. (Chas. Scribner's Sons. 7*s.* 6*d.*).
*Coal and the Coalfields in Wales.* By F. J. NORTH, D.Sc., F.G.S. (National Museum of Wales. 1*s.*).
*The Bryant and May Museum of Fire-Making Appliances.* By MILLER CHRISTY. (Bryant & May Ltd. 5*s.*).
*Sunrise in the West.* By ADRIAN STOKES. (Kegan Paul, Trench, Trubner & Co. Ltd. 7*s.* 6*d.*).
*Social Progress and Educational Waste.* By KENNETH LINDSAY, B.A. (George Routledge & Sons Ltd. 7*s.* 6*d.*).
*The Civilization of the South American Indians.* By RAFAEL KARSTEN, Ph.D. (Kegan Paul, Trench, Trubner & Co. Ltd. 25*s.*).
*The History of Medicine.* By C. G. CUMSTON, M.D. (Kegan Paul, Trench, Trubner & Co. Ltd. 16*s.*).
*The Social Revolution in Austria.* By C. A. MACARTNEY. (Cambridge University Press. 8*s.* 6*d.*).
*The Mind and the Film.* By GERARD FORT BUCKLE. (George Routledge & Sons. 5*s.*).
*Proceedings of the Isle of Wight Natural History Society.* Vol. I. Part VI. For 1925. (The County Press, Newport. 3*s.*).
*Television.* By ALFRED DINSDALE, A.M.I.R.E., Member R.S.G.B. (Sir Isaac Pitman & Sons Ltd. 2*s.*).
*Pomona, or the Future of English.* By BASIS DE SELINCOURT. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s.* 6*d.*).
*A Year amongst the Persians.* By E. G. BROWNE. (Cambridge University Press. 25*s.*).
*Racial Origins of English Character.* By R. N. BRADLEY. (George Allen & Unwin Ltd. 6*s.*).
*Health.* By M. AVERY, B.Sc., M.R.San.I. (Methuen & Co. Ltd. 6*s.*).
*A Trichromatic Colorimeter suitable for Standardization Work.* By J. GUILD, A.R.C.Sc., F.Inst.P., F.R.A.S. (Cambridge University Press.)
*Our Early Ancestors.* By M. C. BURKITT, M.A., F.S.A., F.G.S. (Cambridge University Press. 7*s.* 6*d.*).
*Outwitting Middle Age.* By DR. CARL RAMUS. (George Allen & Unwin Ltd. 7*s.* 6*d.*).
*The Internal Constitution of the Stars.* By A. S. EDDINGTON, M.A., LL.D., D.Sc., F.R.S. (Cambridge University Press. 25*s.*).
*Bulletin de la Section Scientifique.* X'eme anee. No. 3, 4, 5. (Academie Roumaine.)
*Space and Time.* By EMILE BOREL. (Blackie & Son Ltd. 7*s.* 6*d.*).

# Farming the Chinchilla.

**By J. L. von Blon.**

*The latest of the rare fur-bearing animals to be reared in confinement is the chinchilla of South America. Though this animal has become very scarce in its natural surroundings, it has recently been transplanted to California, where a valuable industry seems likely to develop.*

THE beautiful chinchilla (*C. lanigera*) is so nearly extinct in its lofty abode in the Andes that it is thought not many will remain there a few years hence. From vast numbers the dainty little creature has been reduced to a pitiful remnant owing to the demand for its precious fur, and its case might have been almost a repetition of past animal tragedies had not its extinction been averted by an American, Mr. M. F. Chapman, of Los Angeles, who has recently effected a successful transplantation from one continent to another, by taking a colony from Chile to the United States. Over thirty specimens, comprising four generations, are now in his pens in Southern California, and are beginning to increase rapidly, it being estimated that 3,000 will have been bred by 1931. Mr. Chapman has devoted eight years to this unique enterprise—six, as will be related, being spent in South America—and he expects to develop a very valuable fur-farming industry. Since exportation from that country is now prohibited, the colony cannot be replaced.

THE SPECIAL CAGE IN WHICH THE CHINCHILLAS WERE SHIPPED FROM CHILE TO CALIFORNIA.

It s divided into eight compartments, with an ice-container seen at the centre, and was designed to keep the animals cool during their 8,000-mile voyage.

The chinchilla is a hopping rodent slightly less than a foot in length, with a tail of seven to eight inches which curls upward somewhat like that of a squirrel. In head it resembles the cottontail rabbit, and its body is plump. It is a burrowing mammal which lives in underground colonies on the eastern slopes of the Andes in Chile, Peru, Bolivia, and the Argentine Republic, at altitudes of from 12,000 to 19,000 feet. Its fur is dense, soft and fragile, from an inch and a quarter to an inch and a half deep, and of a decided slate-blue colour, which merges into a delicate pearl-grey. On the sides and belly the fur is white, and in the slightest breeze it ripples and changes colour in the most exquisite way. It cannot be imitated with any degree of success, since the hairs grow in tufts of perhaps 500 to each, and are very closely and regularly set.

The pelts were first exported, and then only to Europe, early in the nineteenth century, and it was a long time before they attained wide popularity. How scarce they have now become, however, may be judged from the fact that while in 1898 32,000 dozen skins were exported from Chile, the principal source, at the market price of a shilling each, to-day the trapper receives £20 or more for every one he can obtain. Garments made of the fur are very valuable, and five years ago a sum of four thousand guineas was paid for a full-length chinchilla wrap.

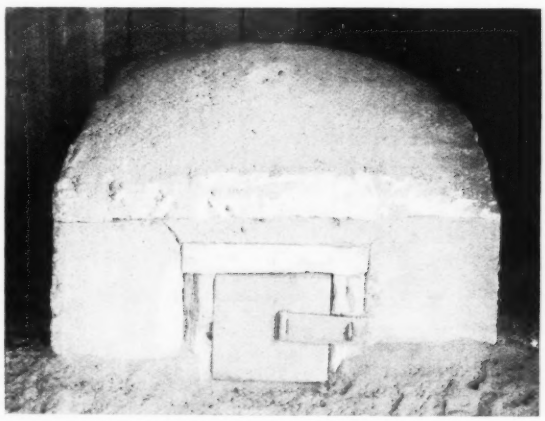
### Shipment from Chile.

All attempts to take live chinchillas out of South America and to rear them in captivity had failed, because of the high altitudes necessary to their existence, and many had been sacrificed, when Mr. Chapman undertook his novel venture. He overcame the difficulty by bringing them very gradually from mountain to sea-level; capturing them after many hazardous experiences in their bleak surroundings,

he kept them two years at a height of 11,000 feet. The next stage was 9,000 feet, where a year's stop was made; then, after successively lower halts during a period of nearly six years, he was ready to sail with a dozen specimens for a land of far different climate. The voyage was the supreme test. Throughout the 8,000-mile journey from Iquique, Chile, to Los Angeles, which lasted forty days, the animals were kept on deck in a carefully-designed screened cage. This was about four by five feet in cross section, and was divided into eight compartments, with a container for 100 pounds of ice in the centre; the cage was curtained all round with canvas, which was kept moistened in order that evaporation from its surface might aid in keeping the contents cool. While passing through the tropics the chinchillas had to be packed in ice; they all shed their fur, and within four days of their new country had to be wrapped in blankets to withstand the change once more to lower temperature. Soon after arrival in California one of the animals died, but the others are now thoroughly acclimatized.

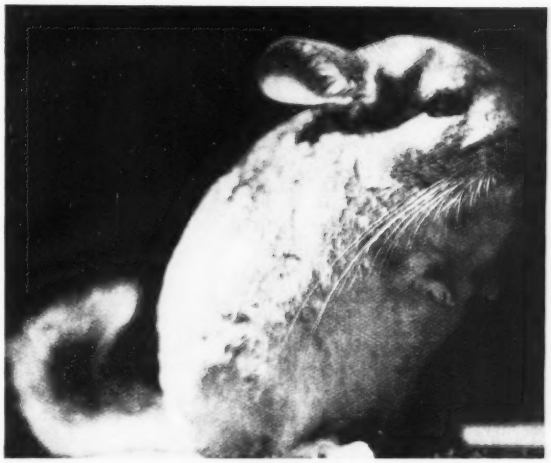
### Habits in Captivity.

The chinchillas are kept at Los Angeles in large screened buildings, which are well ventilated and have double roofs, one of concrete, to withstand the heat. These are divided into pens, six by twelve feet, and in each is a concrete oven-shaped box (eighteen by twelve inches, inside measurement), placed partly underground. The buildings are designed for coolness, quiet, and protection against fire, and are erected in Mr. Chapman's grounds on the outskirts of the city.



THE CHINCHILLAS ARE HOUSED IN OVEN-SHAPED CONCRETE BOXES DESIGNED TO WITHSTAND THE HEAT.

Since under natural conditions the animals live at altitudes of over 10,000 feet, coolness must be maintained in their new surroundings.



ONE OF THE SOUTH AMERICAN CHINCHILLAS NOW BEING SUCCESSFULLY FARMED IN CALIFORNIA.

The animal is a hopping rodent slightly less than a foot in length, with a tail like that of a squirrel and in head resembling the cottontail rabbit.

Since three chinchillas eat less than one chicken does the feed bill of these animals is a minor item. In their natural haunts they subsist on a certain deer-grass and on roots, but in captivity they quickly took to the fare offered them, this consisting of an extensive variety—maize, corn meal, shredded wheat, alfalfa hay, and various raw fruits and vegetables. They have been kept for three months at a time on maize alone, and for equal periods on green alfalfa, proving that their diet is a simple matter; like squirrels, they are fond of nuts, and, sitting on their haunches, will beg for these in the most appealing way. Though requiring much salt, the chinchilla drinks very little water and may go without it for so long a period as a week. It is fed but once a day, eating only at dusk and during the night.

In South America the natives assured Mr. Chapman that water would kill these animals—a suggestion which indicates the small extent of the local knowledge concerning their habits.

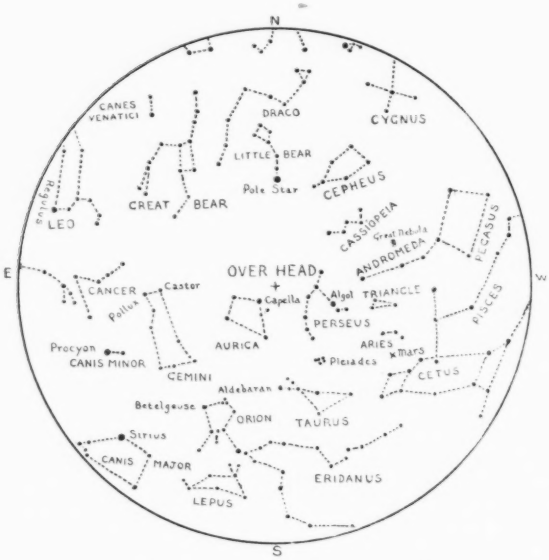
In captivity the chinchillas are clean and docile, and, like kittens, they delight to be fondled, though they are nervous when caught and handled by strangers. The specimen shown in the accompanying photograph was captured when a baby of two weeks old, after it had been left to die by trappers. It was reared by spoon-feeding, and during acclimatization in the Andes was mothered by a cat since, fortunately, it has been found that cats take kindly to these little creatures. Mr. Chapman's colony is composed of the *Chinchilla lanigera*, the finest and scarcest of all species, each animal yielding a pelt twelve by seven to eight inches in size.

# Among the Stars : A Monthly Commentary.

## THE HEAVENS IN JANUARY.

**By J. A. Lloyd, F.R.A.S.**

THE chart is intended to show the aspect of the principal star-groups as seen from London on 1st January at 10 p.m. and on the 31st at 8 p.m. The centre of the map represents the zenith and the outer circle the horizon. Planets visible this




PRINCIPAL STAR GROUPS AS SEEN FROM LONDON

month will be as follows: Venus, which may be seen just above the south-west horizon immediately after sunset towards the end of January; Mars, which is a prominent object in the night sky, being due south about 7.40 p.m. on the first of the month; Jupiter, which can be observed in the south-western sky in the early evening, setting about 8 p.m. at the beginning of the month and about 6 p.m. at the end. Saturn is a morning star and is visible just before sunrise in a south-east direction.

### Mars and its Atmosphere.

Mars has been before the public to a considerable extent of late, and the recent approach of the planet to the earth was fully exploited by the press. Some delightful "howlers" were published about the planet and its supposed inhabitants, and one wonders where some of the reporters got their information. Perhaps the most vexed question with regard to Mars at the present time is the extent and density of its atmosphere. The opinion generally held has been that Mars possesses only a very rarefied atmosphere, but there seems to be a growing suspicion on the part of some astronomers that this view may after all be a mistaken one. The problem has been especially attacked by W. H. Wright at the Lick Observatory. Using the 36-inch Crossley reflector, he has been photographing Mars through various colour-screens in conjunction with specially-prepared photographic plates. He finds that using a screen designed to pass only ultra-violet light the resulting photograph shows nothing of the surface features of the planet, except the polar ice-caps, which appear far more extensive than on photographs taken without screens. Wright argues from this that the polar caps of Mars are largely cloud-banks, overlying solid caps of much smaller dimensions. Comparing the ultra-violet photographs with others taken by means of infra-red light, which show no trace of atmosphere, he considers that the Martian atmospheric envelope must be at least one hundred miles in depth and of a considerable density.

### The Largest Telescope.

There is nothing more astonishing in the history of astronomy than the standard of size and perfection that has been reached in the construction of astronomical apparatus. The 100-inch telescope at Mount Wilson, which at the time of its completion in 1919 was regarded as marking the limit that could be reached in this direction, seems likely soon to be surpassed. A ten-foot telescope is under construction, and there are rumours of a seventeen foot mirror being prepared in France. But the astronomical world has been considerably startled by the publication of designs for a still bigger instrument, having a mirror twenty-five feet in diameter. The designer, Prof. F. G. Pease, of Mount Wilson Observatory, California, considers it could be made, if only about four million pounds were forthcoming. He further considers that with present-day resources, "anything up to a telescope of one hundred feet in aperture can be built, provided one wants to pay for it." Most of the big telescopes hitherto have been the gifts of generous millionaires, but whether any private person will finance the present scheme is problematical. To name only one sphere of work to which such a telescope could be applied, Mr. Pease considers that in the photography of spiral nebulae it would reveal detail that is far beyond the reach of present-day telescopes, and should throw further light on the problem of their nature, which is once more vividly to the fore.

### Spiral Nebulae.

It has always been debated whether the spirals are incorporated with the system of the Milky Way, to which the sun and its family are proved to belong, or whether they form indeed "island universes" in space, distinct from ours. Judging by the recent work of Hubble and others, the latter view seems to be gaining ground. The particular spiral nebula which has come under discussion this time is that known as M. 33, situated in the constellation Triangulum. In this object Hubble has found forty-three variable stars, of which thirty-five are of the Cepheid type—that is, they are stars whose period of variation depends on their absolute magnitude, so that if their period of variation is known, their absolute magnitudes are also determined. Knowing their absolute magnitudes and their apparent magnitudes, their distances can be calculated with remarkable accuracy. It is found that the distance of M. 33 is 800,000 light-years, thus putting it far beyond the confines of the Milky Way. Indeed, Easton long ago suggested that the Milky Way itself is really a spiral nebula, and would appear as such if we could view it from a distant point in space.

# The Month's Wireless Developments.

## TWENTY-FIVE YEARS.

**By F. H. Masters.**

*Editor of "The Electrician."*

On 12th December, 1901, Mr. Marconi sat in a room of a disused barracks on Signal Hill, St. John's, Newfoundland, and heard through a telephone sounds constituting evidence that signals from Poldhu, in Cornwall, had been projected into space, and had crossed the Atlantic. Within the last few weeks representatives of the American Telephone Co. have visited this country to arrange the details of a radio-telephone service, by means of which subscribers in London will be able to be connected with subscribers in New York. This is a wonderful, even an awe-inspiring, result for twenty-five years' work, and deserves that a tribute should be paid to those earnest and painstaking investigators, including Mr. Marconi himself, who have made it all possible. This semi-jubilee comes with appropriate coincidence at a time when Mr. Marconi has opened up the prospect of using the short-wave beam system for long-distance radio-telegraphy, and has thus provided means whereby the most remote parts of the earth can be brought to our doors.

### Early Discoveries.

From the scientific point of view the most important result of Mr. Marconi's 1901 experiments was to establish that the curvature of the earth was no bar to the transmission of wireless signals. This formed a culmination of experiments, which he had started six years before in Bologna. But the history of radio-communication really begins with Clerk Maxwell's paper on "A Dynamical Theory of the Electromagnetic Field," which was read before the Royal Society in 1865. As so often happens, few appreciated the full meaning of what was implied in it, and it was not until twenty years had elapsed that G. F. Fitzgerald showed that a high frequency alternating current in a closed circuit must create Maxwell's electromagnetic radiation, nor until 1888 that Hertz described his experiments with an open radiating oscillator and a nearly closed circuit spark receiver. It is these experiments that may really be described as the birth of wireless. The work of Branly, Croft, Minchin, and Lodge gave us the earliest wireless receiver, the coherer, and it was the last-named who in 1894 was able to demonstrate by its means the principal facts concerning electro-magnetic radiation. As anyone who has used it knows, the coherer was a most capricious instrument. Nevertheless, the transmission and detection of wireless waves was an actuality by 1895. Mr. Marconi himself greatly improved the instrument and made an enormous step forward by earthing one side of the Hertz oscillator and placing it in the vertical instead of horizontal position. But his greatest advance was the production of a transmitter and receiver, the details of which are given in the famous "four sevens" patent of 1900. It was this, in fact, which led up to the successful transatlantic experiments.

Since then much work has been done on the perfection of the apparatus, notably by Poulsen, Duddell, Tesla, Alexanderson, Goldschmidt and Fessenden, but all this has been largely rendered nugatory by Fleming's discovery of the oscillation valve. From 1901 onwards, the advance was exceedingly rapid, both old and new problems were successfully overcome, and within ten years radio had become an absolutely indispensable means of communication between ship and shore, and for naval signalling and scouting. The war only emphasized its value for both military and civil purposes. Though advances during the next twenty-five years can hardly be as spectacular as they have been during the past there is no doubt that the position will be consolidated and that wireless will continue to play an increasing part in the comity of nations.

## THE NEW CORPORATION.

**By Edward Liveing, M.A.,**

*Manchester Station Director, B.B.C.*

This month sees the inauguration of a new broadcasting constitution in this country. Some explanation of the old and new position of broadcasting in this country was given in the editorial notes of the December number of *Discovery*. The finances of the new corporation were dealt with in particular. I do not propose to add any notes to the information already published by the Editor, but I would strongly recommend listeners who see in broadcasting a vital new social force to purchase the very interesting text of the Royal Charter and the Licence and Agreement issued by H.M. Stationery Office under the title "Wireless Broadcasting" (price 6*d*.). It is a lucid document which, through its many short clauses, inevitably shows the range and scope that broadcasting activities have now assumed.

### Wireless for the Blind.

There can have been few bills that have been passed through the House with such unanimous approval as that which was recently sponsored by Captain Ian Fraser, the blind M.P., for the granting of free licences to blind persons to install wireless receiving sets. Wireless programmes and talks have come as a boon to people in sorrow, pain, loneliness, and unhappy circumstances, but to none so much as those whose "one talent which is death to hide" is "lodg'd with them useless." Broadcasting is a home link with the outer world that blind persons can appreciate more fully than any others. Already one of the B.B.C. stations has organized a fund for the installation of wireless in the homes of blind persons in needy circumstances and in blind institutes, which in a few months has reached nearly £700, and the effects of which will be felt over a wide area.

### The Announcer's Pronunciation.

The B.B.C. Advisory Committee on spoken English, the starting of which was commented on in our notes some months ago, has tackled its problems in earnest, and a recent statement issued by its secretary, Mr. A. Lloyd James, Lecturer in Phonetics at the London School of Oriental Studies, is accompanied by a list of fifty-five "doubtful" words about which decisions have been made. The Committee has also been considering the problems of pronunciation offered to the wireless announcer by English and foreign place-names, and intends to tackle British place-names first. As Mr. Lloyd James says, "An announcer who had to inform the country that a serious crime had been committed in the Devonshire village of Ogwell, and that the criminal had been arrested at Aveton Gifford, would be pounced upon by all those throughout the country who knew Ogwell was pronounced with a long 'o' and that Aveton Gifford was 'Awton Jiffăd.' How many people could announce without a single mistake a news bulletin that contained the names Basford, Leominster, Ynysybwl, Schenectady, and Presteign, to mention only a few of the pitfalls that lie in the path of the announcer?"

# Book Reviews.

*Journal of the Marine Biological Association of the United Kingdom.* Vol. XIV. No. 2. Plymouth. (10s. net).

This number of the journal contains thirteen papers, totalling 296 pp., embracing very varied aspects of marine research, and contains much that is fresh in outlook or treatment. As far as the work behind the articles can be characterized as a whole, it may be said clearly to be directed to the elucidation of the metabolism of the sea: study of the physical conditions of the sea, of the relations of marine fauna and flora to these, of the physiology of nutrition and of growth, are all represented, while the descriptive work included is of a character which will be of real assistance to those engaged in studying biological problems of the sea.

Dr. Atkins continues his study of the phosphate content of sea water, and has examined samples from the Pacific and Atlantic Oceans, as well as from waters about the British Isles. The conclusion that the depths of the ocean contain a reservoir of phosphates is confirmed, and the seasonal variations apparently occasioned by the using up of the phosphates of the surface layers by plant growth during summer, traceable in home waters in all the years treated, are found to be less marked in the tropics—a fact ascribed to the sufficiency of light in those latitudes during winter to keep the growth of algae active. Another paper dealing with physical conditions is that of Mr. Hunt, describing a new apparatus for sampling the sea bed, the principle of which is the forcing of the soil into a previously empty container by the pressure of the sea water, operative on the breaking of a glass window as the sampler strikes. It is interesting to note that this utilization of pressure in the collection of deposits occurs at practically the same time as the completion of the more elaborate gear founded on the same principle by Prof. Knudsen of Copenhagen. The latter apparatus has the great advantage of preserving stratification, and thus enabling study of the surface film of detritus so important in some waters; it also takes a very large sample. It is to be feared, however, that the apparatus will be necessarily costly, and for many purposes Mr. Hunt's apparatus may prove adequate.

Mr. F. S Russell continues his study of the vertical distribution of plankton, and his results are made particularly valuable by the use of a depth recorder, kindly lent by the Admiralty. Mr. Russell recognizes several factors in determining the depth at which a given species is chiefly found, but after discussing them concludes that light is the predominant factor for the species studied; and he finds that both range and optimum of light conditions are characteristic for each species. Apart from its scientific interest work along these lines should ultimately prove of distinct importance to fisheries. In another paper he studies the vertical movement of fishes.

Shellfish receive a deal of attention in this issue. Dr. Orton discusses the growth of the cockle as deduced from experiments lasting several years, in which all that is possible seems to have been done to approach natural conditions, since the cockles were kept in a box staked into the river bed, the cockles being marked and examined at intervals. It is of considerable interest to find that even the handling and keeping from water incidental to this treatment resulted in a very definite groove in the shell, which the author terms a disturbance ring This phenomenon reminds one of the rings not to be ascribed to a yearly season which are found so frequently in the otoliths and scales of fishes (false rings), and is a useful reminder that ring structures may register changes of conditions which are not seasonal in the calendar sense. Dr. Orton also has a further report on the lethal effects of T.N.T., by the discharge of which into the sea after the war so much damage was alleged to be done.

Dr. Yonge contributes a study of the nutrition of oysters, both adult and larval, which deals with the structure, macroscopic and microscopic, of the digestive organs from the ciliary apparatus driving food to the mouth onwards, with the nature of the food, and with digestion. The method of injecting gelatin and so producing a cast of the labyrinthine digestive canal is particularly ingenious. This most valuable paper may be termed comprehensive in the fullest sense. It concludes with a useful discussion and a summary under thirty-one heads.

It is impossible in this notice to mention all the papers—though perhaps it should be said that Dr. Lebour continues her work on larval plankton forms, for which all who need to identify plankton are grateful to her. The reports touched upon have been chosen as representative of the aspects of marine biology mentioned in the opening paragraph; and they are sufficient to mark the journal as a definite and valuable contribution to that science.

J. O. Brierley.

*An Adventure in Moral Philosophy.* By Warner Fite, Professor of Philosophy in Princeton University. (Methuen & Co. 10s. 6d.).

This is a scholarly book very well worth reading; its lucid exposition is throughout sustained, and a wide field is covered from which much food for thought can be garnered. At the outset the chief interest in the work depends upon the idea that morality is viewed from quite an unusual angle. Standards, laws, and principles are laid aside, and morality is considered from the standpoint of intelligence. Here then the biologist would claim a moral sense for the lower animals (at least among the higher series of the vertebrates) which undoubtedly are possessors of that faculty. But by the author the idea of intelligence is used in a restricted sense, so that it is not enough only to act morally; we must be cognisant of the fact that we do so In other words, the Moral Being must be endowed with Self-Consciousness. Professor Fite is of the opinion that this faculty is prescriptive of man. The biologist, however, would grant a reflective power (even if in a diluted form) to some of the lower animals. It was Darwin who said "Can we feel sure that an old dog with an excellent memory and some power of imagination as shown by his dreams never reflects on his past pleasures or pains in the chase." Professor Fite asks the question: What is the dog thinking about while he surveys the fire? He looks by his facial expression quite capable of forming abstract ideas. "From any human point of view we seemed compelled to say almost nothing." He lives in almost no world and most of all the author stresses the point that the dog is not aware that he is a dog! Man is the only animal that knows that he is an animal. He is the only self-conscious animal; he is the only really conscious animal, and that in as far as he is a thinking animal. Those who have given attention to the study of animal behaviourism have detected, however, in many of the lower animals the faculty of Imagination. Here again Professor Fite draws a chalk-line; nevertheless we find him logical when, in order that Imagination should be equivalent to Human Intelligence, the usage of poetry and literary criticism must enter into the constitution of mental equipment. Imagination, according to the author's views,

connotes "the experience of thinking for one who thinks." This experience transcends the description of thought known as "reason." On this theme the author is certainly highly interesting. He is perhaps somewhat too apprehensive in believing that a sharp antithesis exists between the values set upon the studies of Science and the Humanities. Nowadays there are many Professors of Literature and History who see the advantage of opening these heretofore water-tight compartments, and thereby of allowing biological concepts to flow in and intermingle with the Humanities. The tenor of this book follows in the wake of many of its predecessors written by academic philosophers. The material for study has its source in the intellectuality of man as we know him, our own kith and kin. But can such "An Adventure in Moral Philosophy" be carried to a strictly logical conclusion if we widen our horizon so as to include the Ancient Hunter who lived at the dawn of Human Evolution: that uncouth man with a hairy coat and slouching deportment; a man like an anthropoid only with a bigger brain? To what extent did he moralise, and if he did at all was this completely denied the gorilla? There is evidence to show that an ethical code already exists in the lower animals; in Man it has become highly elaborated as an evolutionary factor. However, "Morality" in the light of Professor Fite's interpretation obviously is of human origin. If this be granted, it would become a matter of surpassing interest to try and determine at what period in human history "Morality" first arose. While by no means wishing to depreciate the general high merits of the book, it may be said that the author seems to be at his best in the latter half. "The Wisdom of the Serpent," "The Beauty of Knowledge," "The Enjoyment of Life," "The Substance of Life," and "The Experience of Truth," are chapters which will probably make the strongest appeal to the reader.

C. J. PATTEN.

*The History of Witchcraft and Demonology.* By MONTAGUE SUMMERS. The History of Civilization Series. (Kegan Paul. 12*s.* 6*d.*).

Witchcraft, or at any rate the belief in the power of the witch, is by no means extinct. At least three cases have been reported in the press within the last twelve months which showed that among the working-classes and peasant population it survives in all essentials to-day in much the same form in which it existed hundreds of years ago. The witchcraft, however, with which Dr. Summers deals in the "History of Witchcraft and Demonology" is not the sporadic "overlooking" of persons or damaging of cattle or crops of the individual witch, but the organized cult which involved the worship of the Devil, attendance at the witches' Sabbat, and the renunciation of Christianity. This was the object of the great witch prosecutions of mediaeval Europe, and the cause of the death of literally thousands at the hands of the Inquisitors, especially after the issue of the bull against witchcraft by Pope Innocent VIII in 1484. Dr. Summers' review of this phase of the history of witchcraft is written from the point of view of the orthodox theologian of the Roman Church. He therefore regards witchcraft as a form of heresy, and not dynamically as a stage in a general development of religious belief. Consequently, he is unable to accept the view that witchcraft is a survival of a primitive belief in magic in the sense in which that term is understood by the anthropologist; he traces it back to the heresies of the Manichees and Gnostics in which the principle of evil, by a curious perversion of thought, became the central object of veneration. The topsyturvydom of the witches' Sabbat, in which all the ceremonies of the ritual of the Church were reversed—witness the black lamb, and the black candles—might appear to lend colour to this view if other considerations, into which it would be too long to enter here, did not make it more reasonable to conclude otherwise, and to regard the witch as a survival of a once widespread primitive belief. Dr. Summers meets the arguments of the anthropologist who cites parallels to the witchcraft belief among primitive peoples, by classifying the latter with devil worship, a traditional view of primitive religion which can hardly be accepted as adequate in the light of recent research.

Apart from the weakness of Dr. Summers' position in regarding witchcraft as a heresy which has merely assimilated primitive elements from non-Christian religions, Dr. Summers' "History of Witchcraft" is a very complete account of its character as it was said to have flourished in mediaeval times. As to how far the records of the abominations of the cult are to be accepted, the evidence as set forth in this book may speak for itself. It may, however, not be out of place to suggest three factors that should be taken into account in attacking this problem, which is indeed a very real problem not lightly to be dismissed as at most mere hallucination. The effect of *odium theologicum* in framing these accusations must be assessed; the strength of the witches' belief in their own powers of incantations and ceremonial observances; and lastly, the fact that nudity and obscurity, central features of the witches' Sabbat, are employed almost universally in ceremonial and ritual observances to secure the fertility of crops and cattle.

E. N. FALLAIZE.

*The Romance of Comets.* By MARY PROCTOR, F.R.A.S., F.R.Met.S. (Harper & Brothers. 7*s.* 6*d.*).

Half a century ago there was no more popular writer and lecturer on astronomy than Richard A. Proctor. Himself a distinguished research student in this branch of science, he had the uncommon gift of making astronomy a subject of living interest even to the uninitiated, and his premature death thirty-eight years ago was one of the heaviest losses which the science has sustained within the last half-century. His gift for popular exposition has been inherited by his daughter, Miss Mary Proctor, whose interest in astronomy dates from her father's life-time, and who is known as the authoress of some eminently readable books on the subject. Her latest book is a worthy successor to her earlier works. In this volume, Miss Proctor treats in a popular and informative way of the branch of astronomy which deals with comets and meteors. She nowhere goes below the depth of the non-mathematical reader, and her book will make its appeal in the first instance to novices and more especially to young people, whose appetite will be whetted by her pages for stronger scientific meat. "The Romance of Comets," however, ought to prove of value to the astronomer as well as to the novice; for Miss Proctor has collected a great deal of information not easily accessible to the busy man of science. The chapter on the return of Halley's Comet in 1910, which incorporates Miss Proctor's original observations on that occasion, is of very real value. It will certainly be of interest to her readers to know that Miss Proctor was one of the three observers—the other two being well-known American astronomers—who succeeded in observing the second fainter and broader tail of Halley's Comet. The story of Donati's Comet is well told in the third chapter.

At the same time, it must be admitted that there is a certain scrappiness and want of proportion about the book. For

instance, the long quotation from an after-dinner speech by Professor Barnard, extending to nearly five pages, does seem somewhat irrelevant in a book about comets; and this is not the only irrelevance. The volume suffers also from the want of an index. As might be expected of a daughter of R. A. Proctor, the authoress's literary style is of a high order. The book is illustrated by seventeen fine plates.

HECTOR MACPHERSON.

*Microscopic Fresh-Water Life.* By F. J. W. PLASKITT. (London: Chapman & Hall Ltd. 13*s.* 6*d.*).

Mr. F. J. W. Plaskitt has written a very useful book dealing with microscopic fresh-water life, fully illustrated, and well put together. It begins with a detailed account of how such organisms should be collected and sorted out. Many of the plants he deals with are certainly not microscopic, but they carry on them innumerable minute organisms which are fully described. The arrangement of the book is a little confusing. The first chapter deals with such plants as Potamogeton, mosses, duck-weed, and so on. The book then passes on to the lower forms of animal life, including the Amoeba and other Rhizopoda. We then jump back to the algae, which forms one of the most interesting sections of the volume. The Diatoms are fully dealt with and so are the Desmids. Having described these minute plants, we again attack the protozoa, and there is a most useful chapter on Infusoria. Following this comes a detailed account of the Rotifers, which is particularly interesting. Then we come to the Bryozoa, and from them pass on to the minute Crustacea. The special chapter on water-mites is contributed by Mr. Soar, who manages to write much more lucidly than he and his colleague did in the Ray Society's monograph on the same group. The book ends up with a miscellaneous collection of animals, which, curiously enough, includes the Hydra and Water-bears.

The volume is of real value to the student of aquatic life, and the illustrations very greatly enhance its interest. The index might have been a little fuller; it is chiefly occupied with generic names. It is sad to think that the author died very shortly after the publication of his work, and did not live to read the numerous favourable reviews of his most useful treatise which will doubtless appear in many scientific journals. The proposal to expand the volume to a more compendious work must, to the great regret of all lovers of microscopic plants and animals, now be abandoned.

*The Cancer Review.* Vol. I. No. 1. (Issued under the direction of the British Empire Cancer Campaign. 3*s.* 6*d.*).

The way of the scientist in general, and of the doctor in particular, is hard in these latter days. If he would seek information on any question arising in the course of his pursuits he will find, not, as might be expected, a world of workers as ignorant as himself, but a whole host of verbose and enthusiastic authorities. Worse still, they do not all agree; and not all of them know what they set out to discover and what, in fact, they found. Subsidised research is not all to the advantage of knowledge. There is probably a greater flood of imbecile ambiguity flowing from America, the home of highly-paid research, than has ever confused the issues of science since time began.

There is thus ample scope for authoritative selection and abstraction of the avalanche of papers which deal with cancer. The new *Cancer Review* supplies this need. A thoroughly orthodox management and editorial committee here abstract over one hundred papers dealing with cancer in all its aspects. In but a few cases is any attempt at criticism made. This is a pity. Many of the abstractors know well that the papers in question deal with matters which have elsewhere received very different treatment. A cross-reference might save the student many hours of confusion. The best abstracts are those dealing with statistics. It is pointed out that, in the absence of more definite knowledge of the causation of cancer, details of the relation of cancer to occupation, nationality, age, religion, or political eanings are more confusing than useful. The chief impression remaining after reading these abstracts is one of fluffy-mindedness. Most of the papers are centrifugal, if one may so put it. They are attacking side issues. The main issues are clear. Is cancer parasitic? Then where and what is the parasite? Is cancer a perversion of cell-growth, due to any irritant? Then what are the irritants, and what are the normal and abnormal essentials of cell-growth and decay? These are vital questions, at the root of the matter. But too many authors are busy with the dead meat of museum classification.

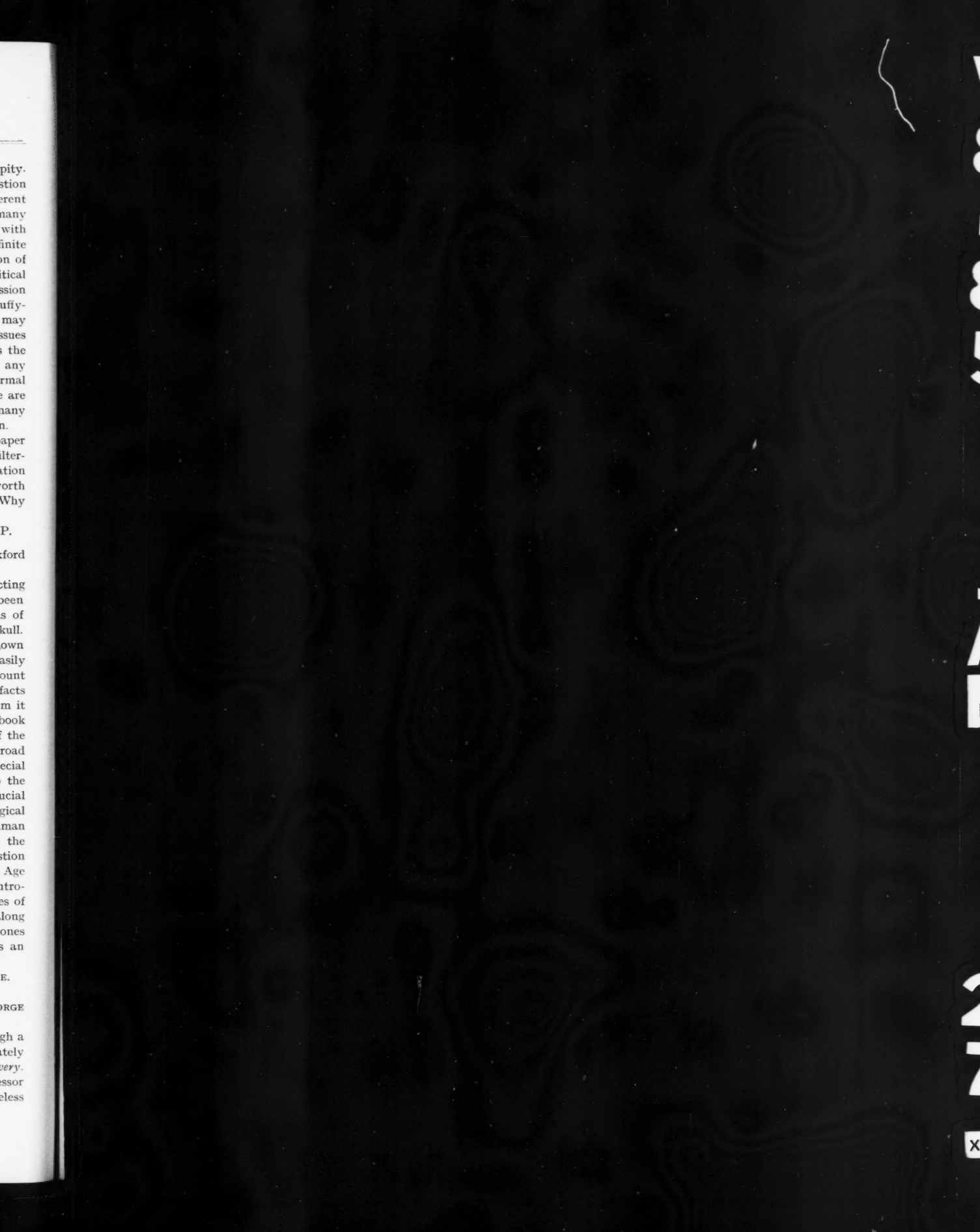
It is, finally, of interest to observe that there is no paper dealing, directly, with Barnard and Gye's work on the filter-passing parasite. The scientific world awaits more information on that point. And the abstractors have not thought it worth while to note any of the numerous reports on the subject. Why not?

R. J. V. P.

*The Stone Age in Rhodesia.* By NEVILLE JONES. (Oxford University Press. 12*s.* 6*d.*).

South Africa as a field of archaeological study is attracting increased attention since its claims to consideration have been emphasized by the discovery there of the skeletal remains of primitive human types—Rhodesian Man and the Boskop Skull. Although stone implements from South Africa have been known to specialists for some time, the literature about them in easily accessible form is limited in amount. Mr. Neville Jones' account of the stone age in Rhodesia states the main outline of the facts in such a way that the scientific archaeologist can get from it the information he requires. At the same time it is not a book for the specialist only. He brings the special problems of the area in relation to archaeological studies generally in broad terms, and thus enables those who have not made a special study of the subject to follow the trend of research into the cultural affinities of the South African Stone Age. The crucial problem is, of course, its morphological and chronological relation to the Stone Age of Western Europe. The Bushman paintings and drawings are described and discussed on the same lines. Both streams of evidence converge on the question of how and at what stages of the European Palaeolithic Age the Upper and Lower Palaeolithic of South Africa were introduced into that area, and whether there were several waves of infusion, or one only at an early date, which developed along lines parallel to, but uninfluenced by, Europe. Mr. Jones discusses the evidence both lucidly and impartially. It is an admirable statement of a difficult case.

E. N. FALLAIZE.

*The Wonder and the Glory of the Stars.* By PROFESSOR GEORGE FORBES, F.R.S. (Ernest Benn Ltd. 8*s.* 6*d.*).

We are asked by Messrs. Ernest Benn to state that through a clerical error Professor George Forbes' name was inaccurately printed in the previous advertisement of his book in *Discovery*. Though no reader, of course, can have confused Professor Forbes with the actor of his name, the mistake is nevertheless much regretted.